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[Inventor]
  [Address] c/o Sony Corporation, 7-35, Kitashinagawa 6-chome, Shinagawa-ku, Tokyo
  [Name] Motoki KATO
[Applicant for Patent]
  [Id. No.] 000002185
  [Name] Sony Corporation
[Agent]
  [Id. No.] 100082131
  [Patent Attorney]
  [Name] Yoshio INAMOTO
  [Phone No.] 03-3369-6479
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  [Name of Document] Specification 1
  [Name of Document] Drawings 1
  [Name of Document] Abstract 1

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[Name of Document] CLAIMS

[Claim 1]

An information processing apparatus comprising:

encoding means for encoding an input stream so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream;

table generating means for generating a table in which information is written for associating IDs that respectively identify the base stream and the first to n-th extension streams, which are encoded by the encoding means, with the base stream and the first to n-th extension streams;

adding means for adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by the encoding means; and

packetizing means for packetizing the base stream and the first to n-th extension streams, to which the IDs are added by the adding means, and the table into TS packets.

[Claim 2]

An information processing method comprising:

an encoding step of encoding an input stream so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream;

a table generating step of generating a table in which information is written for associating IDs that respectively identify the base stream and the first to n-th extension streams, which are encoded by processing in the encoding step, with the base stream and the first to n-th extension streams;

an adding step of adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by processing in the encoding step; and

a packetizing step of packetizing the base stream and the first to n-th extension streams, to which the IDs are added by processing in the adding step, and the table into TS packets.

[Claim 3]

A program for allowing a computer to execute processing including:

an encoding step of encoding an input stream so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream;

a table generating step of generating a table in which information is written for associating IDs that respectively identify the base stream and the first to n-th extension streams, which are encoded by processing in the encoding step, with the base stream and the first to n-th extension streams;

an adding step of adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by processing in the encoding step; and

a packetizing step of packetizing the base stream and the first to n-th extension streams, to which the IDs are added by processing in the adding step, and the table into TS packets.

[Claim 4]

An information processing apparatus comprising:

input means for inputting a stream including TS packets forming a base stream, TS packets forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets;

determining means for referring to the table stored in the TS packet input by the input means and determining the type of processable stream;

selecting means for selecting, from the stream, the TS packets having the ID associated with the stream determined by the determining means to be processable; and

decoding means for decoding the TS packets selected by the selecting means.

[Claim 5]

The information processing apparatus according to Claim 4, further comprising:

buffering means for buffering, with respect to each ID, the TS packets selected by the selecting means.

[Claim 6]

An information processing method comprising:

an input step of inputting a stream including TS packets forming a base stream, TS packets forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets;

a determining step of referring to the table stored in the TS packet input by processing in the input step and determining the type of processable stream;

a selecting step of selecting, from the stream, the TS packets having the ID associated with the stream determined by processing in the determining step to be processable; and

a decoding step of decoding the TS packets selected by processing in the selecting step.

[Claim 7]

A program for allowing a computer to execute processing including:

an input step of inputting a stream including TS packets forming a base stream, TS packets forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets;

a determining step of referring to the table stored in the TS packet input by processing in the input step and determining the type of processable stream;

a selecting step of selecting, from the stream, the TS packets having the ID associated with the stream determined by processing in the determining step to be processable; and

a decoding step of decoding the TS packets selected by processing in the selecting step.

[Name of Document] SPECIFICATION

[Title of the Invention] INFORMATION PROCESSING APPARATUS, INFORMATION PROCESSING METHOD, AND PROGRAM

[Technical Field]

[0001]

The present invention relates to information processing apparatuses, information processing methods, and programs, and in particular, to an information processing apparatus, an information processing method, and a program, for processing a stream including a base stream and extension streams at a plurality of levels.

[Background Art]

[0002]

An MPEG (Moving Picture Experts Group) 2 audio stream has backward compatibility so that it can be played back by even an MPEG1 audio decoder. In other words, the MPEG2 audio stream has a structure including an MPEG1 audio stream portion as a base portion and an MPEG2 audio portion as an extension portion thereof.

[0003]

In the DVD (Digital Versatile Disc) video format, a technology for multiplexing an MPEG2 audio stream into a program stream is disclosed (e.g., Non-Patent Document 1). Fig. 1 is an illustration of the structure of a program stream 1 in the DVD video format. The program stream 1 in

Fig. 1 includes a video pack 11, an MPEG2 audio pack 12, and a plurality of packs 13-1 to 13-j (j represents an arbitrary natural number).

[0004]

The MPEG2 audio pack 12 includes a pack header 21, a PES (Packetized Elementary Stream) packet header 22, an MPEG1 audio data (Base) 23, a PES packet header 24, and an MPEG2 audio data (Extension) 25. In addition, the payload of the MPEG2 audio pack 12 includes an MPEG1 audio PES packet including the PES packet header 22 and the MPEG1 audio data 23, and an MPEG2 audio extension PES packet including the PES packet header 24 and the MPEG2 audio data 25.

[0005]

When playing back the MPEG2 audio pack 12, a playback apparatus that can decode only an MPEG1 audio stream (playback apparatus only for MPEG1) separates and plays back only the PES packet header 22 and the MPEG1 audio data 23, which correspond to the MPEG1 audio stream portion. A playback apparatus that can perform decoding of up to an MPEG2 audio stream (playback apparatus capable of playing back up to an extension audio stream) separates and plays back both base and extension audio streams. Specifically, the latter playback apparatus plays back, in addition to the PES packet header 22 and the MPEG1 audio data 23, the PES packet header 24 and the MPEG2 audio data 25, which correspond to the MPEG2 extension audio stream.

[Non-Patent Document 1] DVD Specifications for Read-Only Disc Part 3; Version1.1

[Disclosure of the Invention]

[Problems to be Solved by the Invention]

[0006]

However, for stream extensibility in the recent years, in the case of the program stream shown in Fig. 1, the stream structure is determined as a format. Thus, there is a problem in that a further audio stream extension cannot be added.

[0007]

This results in reduction of extensibility and causes a problem in that it is difficult to realize standardization of playback apparatuses.

[0008]

In addition, when an audio stream is broadcast, it is common to perform broadcasting by using a TS (Transport Stream). However, the use of a TS is inappropriate in the program stream encoding method shown in Fig. 1. Specifically, a TS packet corresponding to a pack (e.g., the MPEG2 audio pack 12 in Fig. 1) has a relatively small length of 188 bytes. When two PES packets, a base portion (MPEG1) and an extension portion (MPEG2), are multiplexed in the TS packet, there is a problem in that the encoding efficiency is low.

[0009]

The present invention has been made in view of the above circumstances and is intended to enable encoding and decoding of a stream including a base stream and extension streams at a plurality of levels.

[Means for Solving the Problems]

[0010]

A first information processing apparatus of the present invention includes encoding means for encoding an input stream so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream; table generating means for generating a table in which information is written for associating IDs that respectively identify the base stream and the first to n-th extension streams, which are encoded by the encoding means, with the base stream and the first to n-th extension streams; adding means for adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by the encoding means; and packetizing means for packetizing the base stream and the first to n-th extension streams, to which the IDs are added by the adding means, and the table into TS packets.

[0011]

A first information processing method of the present invention includes an encoding step of encoding an input stream so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream; a table generating step of generating a table in which information is written for associating IDs that respectively identify the base stream and the first to n-th extension streams, which are encoded by processing in the encoding step, with the base stream and the first to n-th extension streams; an adding step of adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by processing in the encoding step; and a packetizing step of packetizing the base stream and the first to n-th extension streams, to which the IDs are added by processing in the adding step, and the table into TS packets.

[0012]

A first program of the present invention is a program for allowing a computer to execute processing including an encoding step of encoding an input stream so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream; a table generating step of generating a table in which information is written for associating IDs that respectively identify the base stream and the first to n-th extension streams, which are encoded by processing in the encoding step, with the base stream and the first to n-th extension streams; an adding step of adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by processing in the encoding step; and a packetizing step of packetizing the base stream and the first to n-th extension streams, to which the IDs are added by processing in the adding step, and the table into TS packets.

[0013]

A second information processing apparatus of the present invention includes input means for inputting a stream including TS packets forming a base stream, TS packets forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets; determining means for referring to the table stored in the TS packet input by the input means and determining the type of processable stream; selecting means for selecting, from the stream, the TS packets having the ID associated with the stream determined by the determining means to be processable; and decoding means for decoding the TS packets selected by the selecting means.

[0014]

The second information processing apparatus may further include buffering means for buffering, with respect to each ID, the TS packets selected by the selecting means.

[0015]

A second information processing method of the present invention includes an input step of inputting a stream including TS packets forming a base stream, TS packets forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets; a determining step of referring to the table stored in the TS packet input by processing in the input step and determining the type of processable stream; a selecting step of selecting, from the stream, the TS packets having the ID associated with the stream determined by processing in the determining step to be processable; and a decoding step of decoding the TS packets selected by processing in the selecting step.

[0016]

A second program of the present invention is a program for allowing a computer to execute processing including an input step of inputting a stream including TS packets forming a base stream, TS packets forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets; a determining step of referring to the table stored in the TS packet input by processing in the input step and determining the type of processable stream; a selecting step of selecting, from the stream, the TS packets having the ID associated with the stream determined by processing in the determining step to be processable; and a decoding step of decoding the TS packets selected by processing in the selecting step.

[0017]

According to the first present invention, an input stream is encoded so as to include, among a base stream and first to n-th extension streams, at least the base stream and the first extension stream. A table is generated in which information is written for associating IDs that respectively identify the encoded base stream and the encoded first to n-th extension streams with the base stream and the first to n-th extension streams. The corresponding IDs are added to the encoded base stream and the encoded first to n-th extension streams. The base stream, the first to n-th extension streams, and the table are packetized into TS packets.

[0018]

According to the second present invention, a stream is input, which includes TS packets forming a base stream, TS packets forming each of first to n-th extension streams, and a TS packet storing a table in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets. The table is referred to and the type of processable stream is determined. From the stream, the TS packets having the ID associated with the stream determined to be processable are selected and decoded.

[Advantages]

[0019]

According to the first present invention, processing in accordance with stream extension can be performed. In particular, according to the present invention, even when a stream is extended, encoding in accordance with an information processing apparatus at a receiving side can be performed.

[0020]

According to the second present invention, processing in accordance with stream extension can be performed. In particular, according to the present invention, even when an extended stream is input, decoding in accordance with the processing capacity of the information processing apparatus can be performed.

[Best Mode for Carrying Out the Invention]

[0021]

Embodiments of the present invention will be described below. The following description indicates correspondence relationships between the invention described in this specification and the embodiments of the invention as examples. This description is used to confirm that the embodiments described in this specification and supporting the invention are described in this specification. Therefore, even if there is an embodiment not here described as a correspondence to the invention but described in the embodiments of the invention, it does not mean that the embodiment does not correspond to the invention. In contrast, even if an embodiment is here described as a correspondence of the invention, it does not mean that the embodiment does not correspond to inventions other than that invention.

[0022]

Further, this description does not mean all the inventions described in this specification. In other words, this description does not deny existence of inventions described in this specification and not claimed in this application, namely, existence of inventions that will be divisionally applied, will be appeared by amendment, and will be added in future.

[0023]

The information processing apparatus (for example, the transmitter 41 in Fig. 3) described in claim 1 includes encoding means (for example, the audio encoder 72 in Fig. 3 for executing the process of step S13 in Fig. 6) for encoding an input stream (for example, the audio stream) so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream; table generating means (for example, the extraction-information adding section 75 in Fig. 3 for executing the process of step S17 in Fig. 6) for generating a table (for example, the table in which PAT and PMT are written in Fig. 7 and Fig. 8) in which information is written for associating IDs (for example, PID) that respectively identify the base stream and the first to n-th extension streams, which are encoded by the encoding means, with the base stream and the first to n-th extension streams; adding means (for example, the TS packetizing section 76 in Fig. 3 for executing the process of step S33 in Fig. 9) for adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by the encoding means; and packetizing means (for example, the TS packetizing section 76 3 for executing the processes of step S32 and step S33 in Fig. 9) for packetizing the base stream and the first to n-th extension streams, to which the IDs are added by the adding means, and the table into TS packets.

[0024]

The information processing method described in claim 2 includes an encoding step (for example, step S13 in Fig. 6) of encoding an input stream (for example, the audio stream) so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream; a table generating step (for example, step S17 in Fig. 6) of generating a table (for example, the table in which PAT and PMT are written in Fig. 7 and Fig. 8) in which information is written for associating IDs (for example, PID) that respectively identify the base stream and the first to n-th extension streams, which are encoded by processing in the encoding step, with the base stream and the first to n-th extension streams; an adding step (for example, step S33 in Fig. 9) of adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by processing in the encoding step; and a packetizing step (for example, step S32 and step S34 in Fig. 9) of packetizing the base stream and the first to n-th extension streams, to which the IDs are added by processing in the adding step, and the table into TS packets.

[0025]

The program described in claim 3 for allowing a computer to execute processing including an encoding step (for example, step S13 in Fig. 6) of encoding an input stream (for example, the audio stream) so as to include, among a base stream and first to n-th extension streams having extensibility for the base stream, at least the base stream and the first extension stream; a table generating step (for example, step S17 in Fig. 6) of generating a table (for example, the table in which PAT and PMT are written in Fig. 7 and Fig. 8) in which information is written for associating IDs (for example, PID) that respectively identify the base stream and the first to n-th extension streams, which are encoded by processing in the encoding step, with the base stream and the first to n-th extension streams; an adding step (for example, step S33 in Fig. 9) of adding the corresponding IDs to the base stream and the first to n-th extension streams encoded by processing in the encoding step; and a packetizing step (for example, step S32 and step S34 in Fig. 9) of packetizing the base stream and the first to n-th extension streams, to which the IDs are added by processing in the adding step, and the table into

TS packets.

[0026]

The information processing apparatus (for example, the audio-stream processing section 122 in Fig. 16) described in claim 4 includes input means (for example, the input portion 151 in Fig. 16) for inputting a stream including TS packets (for example, the TS packet 92 in Fig. 5) forming a base stream, TS packets (for example, the TS packets 93-1 to 93-n in Fig. 5) forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet (for example, the TS packets 90, 91 in Fig. 5) storing a table (for example, Fig. 7, Fig. 8) in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets; determining means (for example, the filter control portion 152 in Fig. 16 for executing the process of step S94 in Fig. 17) for referring to the table stored in the TS packet input by the input means and determining the type of processable stream; selecting means (for example, the PID filter 261 in Fig. 16 for executing the process of step S95 in Fig. 17) for selecting, from the stream, the TS packets having the ID associated with the stream determined by the determining means to be processable; and decoding means (for example, the audio decoder 262 in Fig. 16 for executing the process of step S98 in Fig. 17) for decoding the TS packets selected by the selecting means.

[0027]

The information processing apparatus described in claim 5, further includes buffering means (for example, the base buffer 154 and the extension buffers 202-1 to 202-n in Fig. 16) for buffering, with respect to each ID, the TS packets selected by the selecting means.

[0028]

The information processing method described in claim 6 includes an input step (for example, step S91 in Fig. 17) of inputting a stream including TS packets (for example, the TS packet 92 in Fig. 5) forming a base stream, TS packets (for example, the TS packets 93-1 to 93-n in Fig. 5) forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet (for example, the TS packets 90, 91 in Fig. 5) storing a table (for example, Fig. 7, Fig. 8) in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets; a determining step (for example, step S94 in Fig. 17) of referring to the table stored in the TS packet input by processing in the input step and determining the type of processable stream; a selecting step (for example, step S95 in Fig. 17) of selecting, from the stream, the TS packets having the ID associated with the stream determined by processing in the determining step to be processable; and a decoding step (for example, step S98 in Fig. 17) of decoding the TS packets selected by processing in the selecting step.

[0029]

The program described in claim 7 for allowing a computer to execute processing including: an input step (for example, step S91 in Fig. 17) of inputting a stream including TS packets (for example, the TS packet 92 in Fig. 5) forming a base stream, TS packets (for example, the TS packets 93-1 to 93-n in Fig. 5) forming each of first to n-th extension streams having extensibility for the base stream, and a TS packet (for example, the TS packets 90, 91 in Fig. 5) storing a table (for example, Fig. 7, Fig. 8) in which information is written for associating IDs that respectively identify the TS packets with the base stream or the first to n-th extension streams formed of the TS packets; a determining step (for example, step S94 in Fig. 17) of referring to the table stored in the TS packet input by processing in the input step and determining the type of processable stream; a selecting step (for example, step S95 in Fig. 17) of selecting, from the stream, the TS packets having the ID associated with the stream determined by processing in the determining step to be processable; and a decoding step (for example, step S98 in Fig. 17) of decoding the TS packets selected by processing in the selecting step.

[0030]

Embodiments of the present invention will be described below with reference to drawings.

[0031]

Fig. 2 is a diagram showing an example of the configuration of the entirety of a transmitting/receiving system to which the present invention is applied.

[0032]

This transmitting/receiving system 40 includes a transmitter 41 and a receiver 42. The transmitter 41 is an apparatus, such as a broadcasting station, for transmitting a stream including a plurality of TS packets. The receiver 42 is a household apparatus, such as a household set-top box, for receiving the stream.

[0033]

In this embodiment, the transmitter 41 encodes an audio stream to generate TS packets and transmits the TS packets, and the receiver 42 receives the TS packets and decodes the TS packets to acquire the audio stream.

[0034]

Fig. 3 is a block diagram showing an example of the configuration of the transmitter 41 in Fig. 2.

[0035]

The transmitter 41 includes an input section 71, an audio encoder 72, a base buffer 73, extension buffers 74-1 to 74-n, an extraction-information adding section 75, a TS packetizing section 76, and a transmitting section 77, in which n represents an arbitrary natural number equal to one or greater.

[0036]

An audio stream to be transmitted is input to the input section 71. The audio encoder 72 encodes the audio stream. The audio encoder 72 in Fig. 2 is an encoder corresponding to the n-th extension audio stream. That is, the audio encoder 72 can encode the audio stream into a base stream and extension audio streams at a plurality of levels ranging from the first to n-th levels.

[0037]

In this embodiment, the larger the value of the level n, the higher the extensibility is, resulting in better audio playback quality and higher functionality. The audio encoder 72 encodes the audio stream into the base stream and the first to n-th extension streams and supplies the encoded streams to the corresponding base buffer 73 the extension buffers 74-1 to 74-n at the corresponding levels. For example, the audio encoder 72 supplies the encoded base audio stream (BS) to the base buffer 73, supplies the encoded first extension audio stream (Ext1) to the extension buffer 74-1, supplies the encoded second extension audio stream (Ext2) to the extension buffer 74-2, and similarly supplies the encoded n-th extension audio stream (ExtN) to the extension buffer 74-n. Here, the level of the extension audio stream corresponds to the reference numeral of the buffer. Also, the base audio stream is represented as BS, and the first to n-th extension audio streams are represented as Ext1 to ExtN, respectively.

[0038]

After separating the audio stream into the base stream and the first to n-th extension audio streams, the audio encoder 72 in this embodiment may encode the streams. Alternatively, as the result of encoding the audio stream, the base stream and the first to n-th extension audio streams may be output.

[0039]

The base buffer 73 stores (buffers) the base audio stream, and the extension buffers 74-1 to 74-n store (buffer) the first to n-th extension audio streams, respectively. Under the control of the TS packetizing section 76, the base buffer 73 and the extension buffers 74-1 to 74-n read the audio streams stored therein.

[0040]

The extraction-information adding section 75 generates tables, which are extraction information, so that at the decoding side the extension audio stream at a desired level is extracted from the base audio stream and the first to n-th extension audio streams. In the tables, information is written for associating IDs (PIDs (Packet Identification)) that respectively identify the base audio stream and the first to n-th extension audio streams with the base audio stream and the first to n-th extension audio streams. Specifically, the tables include a PAT (Program Association Table) and a PMT (Program Map Table). The details of the tables are described below with reference to Figs. 7 and 8. The extraction-information adding section 75 supplies the tables to the TS packetizing section 76.

[0041]

The TS packetizing section 76 controls the base buffer 73 and the extension buffers 74-1 to 74-n to acquire the base audio stream and the first to n-th extension audio streams and also acquires the tables supplied from the extraction-information adding section 75. Also, the TS packetizing section 76 packetizes the tables into TS packets and, based on the tables, packetizes the base audio stream and the first to n-th extension audio streams into TS packets (generates TS packets). At this time, the TS packetizing section 76 adds the PIDs that identify the types of streams (the base audio stream and the first to n-th extension audio streams) based on the tables. The TS packetizing section 76 supplies the generated TS packets to the transmitting section 77. The transmitting section 77 transmits the TS packets. Here, the plural TS packets are transmitted in sequence, resulting in transmission of one stream (consisting of a plurality of TS packets).

[0042]

The PID identifies each packet (TS packet (transport packet) forming an MPEG TS, and the PID having a unique value is added to each packet. In other words, in order that the receiver 42 at the receiving side selects a packet of an extension audio stream at a desired level, the PID value added to this packet is necessary.

[0043]

Next, the structure of a TS (transport stream) in which the base audio stream and the extension audio streams at a plurality of levels are multiplexed is described with reference to Figs. 4 and 5.

[0044]

In the example of Fig. 4, a TS includes a base audio stream 81 and first to n-th extension audio streams 82-1 to 82-n. Each of the base audio stream 81 and the first to n-th extension audio streams 82-1 to 82-n is encoded in units of a predetermined number of audio samples, and each unit is indicated by a parenthesized subscript. Specifically, for example, the base audio stream 81 is separated into a plurality of units BS(1), BS(2), ..., BS(n) and encoded. A set of units having the same subscript, for example, BS(1), Ext1(1), Ext2(1), ..., ExtN(1), is synchronously encoded by the audio encoder 72 and synchronously played back (decoded).

[0045]

The TS packetizing section 76 multiplexes the base audio stream 81 and the first to n-th extension audio streams 82-1 to 82-n into TS packets having different PIDs (packet IDs), as shown in Fig. 5. One TS packet stores data of, for example, 188 bytes.

[0046]

The TS stream in Fig. 5 includes a TS packet 90 in which a PAT (Program Association Table) table is written, a TS packet 91 in which a PMT (Program Map Table) table is written, a TS packet 92 of the base audio stream (BS) with PID = a0, a TS packet 93-1 of the first extension audio stream (Ext1) with PID = a1, a TS packet 93-2 of the second extension audio stream (Ext2) with PID = a2, ..., and a TS packet 93-n of the n-th extension audio stream (ExtN) with PID = aN. The TS packet 91 of the table is transmitted by the transmitter 41 every predetermined period.

[0047]

In this embodiment, the receiver 42 at the playback side is capable of decoding at least the base audio stream (BS). When the receiver 42 at the playback side can play back extension audio streams up to a predetermined m-th level (m represents a natural number equal to one or greater, and $m \leq n$), the receiver 42 can decode the base audio stream and the first to m-th extension audio streams. Regarding the relationships between the base audio stream and the extension audio streams, for example, the larger the value n of the decodable extension audio stream, the better the audio playback quality is and the higher the functionality is.

[0048]

Next, a TS packet transmitting process executed by the transmitter 41 in Fig. 3 is described with reference to the flowchart in Fig. 6. This process is initiated when the power of the transmitter 41 is turned on to input an audio stream to the input section 71.

[0049]

In step S11, the input section 71 receives the input audio stream. In step S12, the input section 71 outputs the received audio stream to the audio encoder 72.

[0050]

In step S13, the audio encoder 72 encodes the base audio stream and the first to n-th extension audio streams. As a result, the audio encoder 72 outputs the base audio stream and the first to n-th extension audio streams shown in Fig. 4 in (vertically) synchronized form.

[0051]

In step S14, the audio encoder 72 outputs the encoded audio streams separately for each level (type of stream). Specifically, the audio encoder 72 outputs the encoded base audio stream to the base buffer 73, the encoded first extension audio stream to the extension buffer 74-1, the encoded second extension audio stream to the extension buffer 74-2, and the encoded n-th extension audio stream to the extension buffer 74-n.

[0052]

In step S15, the base buffer 73 and the first to n-th extension buffers 74-1 to 74-n respectively store (buffer) the encoded audio streams.

[0053]

In step S16, the base buffer 73 and the first to n-th extension buffers 74-1 to 74-n respectively output the encoded audio streams with predetermined timing. Actually, the TS packetizing section 76 controls the buffers (the base buffer 73 and the first to n-th extension buffers 74-1 to 74-n) so as to read the corresponding audio streams therefrom.

[0054]

In step S17, the extraction-information adding section 75 generates tables and supplies the tables to the TS packetizing section 76. Specifically, the extraction-information adding section 75 generates the tables shown in Figs. 7 and 8 and supplies the tables to the TS packetizing section 76.

[0055]

Fig. 7 illustrates the PAT (Program Association Table). Specifically, the PMT-PID corresponding to each program-number is written. In the example of Fig. 7, PMT-PID for program-number 1 is "X" and PMT-PID for program-number 2 is "Y". The value of the PMT-PID is referred to by the PMT (Program Map Table) shown in Fig. 8. In Fig. 8, stream_entry in the case where the PID is "X" is written. Specifically, the PMT includes BASE_PID = a0, Ext1_PID = a1, Ext2_PID = a2, ..., ExtN_PID = aN. It is clear that, according to Figs. 7 and 8, the PID of the base audio stream (BS) is "a0"; the PID of the first extension audio stream Ext1 is "a1"; the PID of the second extension audio stream Ext2 is "a2"; and similarly the PID of the n-th extension audio stream ExtN is "aN". Accordingly, as shown in Fig. 5, the PID corresponding to the encoding level is identifiable.

[0056]

In this embodiment, the PAT and the PMT are transmitted in different TS packets. In other words, as shown in Fig. 5, the TS packet 90 of the table in which the PAT is written and the TS packet 91 of the table in which the PMT is written are transmitted.

[0057]

Referring back to Fig. 6, in step S18, the TS packetizing section 76 executes a TS packet generating process. The details of the process are described below with reference to Fig. 9. The TS packets generated by the TS packetizing section 76 are output to the transmitting section 77.

[0058]

In step S19, the transmitting section 77 transmits the TS packets (an audio stream including the plural TS packets) to the receiver 42. Specifically, the stream including the TS packets 90 and 91 of the tables, the TS packet 92 of the base audio stream, and the TS packets 93-1 to 93-n of the first to n-th extension audio streams is transmitted. After that, the process is finished. Although the TS packets are transmitted to the receiver 42 in this embodiment, the TS packets may be recorded in various types of recording media, which are not shown. Alternatively, transmission of the TS packets to the receiver 42 may be performed indirectly by recording the TS packets in a recording medium and then supplying the recording medium to the receiver 42.

[0059]

Next, the details of the TS packet generating process in step S18 of Fig. 6 are described with reference to the flowchart of Fig. 9.

[0060]

In step S31, the TS packetizing section 76 acquires the tables. The tables are such as those shown in Figs. 7 and 8, which are generated in step S17 of Fig. 6. That is, the tables include information in which the PIDs that respectively identify the base audio stream and the first to n-th extension audio streams and information that respectively identifies the base audio stream and the first to n-th extension audio streams are written.

[0061]

In step S32, the TS packetizing section 76 packetizes the tables into TS packets (generates TS packets based on the tables) and outputs the TS packets to the transmitting section 77 (and the transmitting section 77 transmits the TS packets in turn to the receiver 42). Accordingly, the TS packet 90 in which the PAT in Fig. 5 is written and the TS packet in which the PMT is written are generated and output to the transmitting section 77. In this process, the TS packets are transmitted only once. Actually, however, the TS packets in which the tables are written are transmitted every predetermined period of time. Accordingly, even when the receiver 42 starts receiving the stream in the middle thereof, the receiver 42 can acquire the tables and thus reliably decode the stream.

[0062]

In step S33, the TS packetizing section 76 adds, based on the tables, the PIDs to the corresponding audio streams from the base buffer 73 and the first to n-th extension buffers 74-1 to 74-n. Although the tables are packetized into TS packets by the processing in step S31 and then transmitted, it is assumed here that the tables are held by the TS packetizing section 76. Accordingly, PID = a0 is added to the base audio stream (BS), PID = a1 is added to the first extension audio stream (Ext1), PID = a2 is added to the second extension audio stream (Ext2), and similarly PID = aN is added to the n-th extension audio stream (ExtN).

[0063]

In step S35, the TS packetizing section 76 generates TS packets, respectively, based on the audio streams from the base buffer 73 and the first to n-th extension buffers 74-1 to 74-n. As shown in Fig. 5, the base audio stream and the first to n-th extension audio streams are generated as TS packets having respective different PIDs (packet IDs). In other words, the PIDs for determining the types of streams are added to the TS packets.

[0064]

In step S35, the TS packetizing section 76 outputs the generated TS packets to the transmitting section 77. After that, the process returns to step S18 of Fig. 6.

[0065]

By the processes in Figs. 6 and 9, the transmitter 41 that can encode the n-th extension audio stream separates the encoded data into the base audio stream and the first to n-th extension audio streams; adds the PIDs to the audio streams based on the tables; packetizes the separated audio streams into TS packets and transmits the TS packets; and packetizes the tables into TS packets and transmits the TS packets. In other words, the audio stream including the plural TS packets having the PIDs identifying the types of streams and the TS packets of the tables is transmitted to the receiver 42.

[0066]

The stream transmitted by the transmitter 41 includes the TS packets forming the base audio stream, the TS packets forming the first to n-th extension audio streams, and the TS packets of the tables in which information is written for associating the PIDs that respectively identify these TS packets with the base audio stream and the first to n-th extension audio streams. Since the PIDs that identify the types of audio streams are added to the TS packets forming the base audio stream and the TS packets forming the first to n-th extension audio streams, the receiving side can perform decoding in accordance with its processing capacity. The receiver 42 at the receiving side is described below.

[0067]

Fig. 10 is a block diagram showing an example of the configuration of the receiver 42 in Fig. 2.

[0068]

The receiver 42 includes a receiving section 121, an audio-stream processing section 122, and an output section 123. The receiving section 121 receives the TS packets, and the audio-stream processing section 122 performs processing concerning an audio stream. Specifically, the audio-stream processing section 122 extracts an audio stream by, for example, decoding the received TS packets. The output section 123 outputs the audio stream processed by the audio-stream processing section 122.

[0069]

The audio-stream processing section 122 extracts a different audio stream depending on its decoding capability. The audio-stream processing section 122 is described below.

[0070]

Fig. 11 is a diagram showing an example of the configuration of the audio-stream processing section 122 including an audio decoder that can decode only the base audio stream.

[0071]

The audio-stream processing section 122 in Fig. 11 includes an input portion 151, a filter control portion 152, a PID filter 153, a base buffer 154, and an audio decoder

155.

[0072]

The input portion 151 receives input of TS packets of an audio stream supplied by the receiving section 121 in Fig. 10. The input portion 151 supplies, among the TS packets of the audio stream, the TS packets of the tables (tables illustrated in Figs. 7 and 8) to the filter control portion 152, and the remaining TS packets (e.g., the TS packets of the base audio stream and the TS packets of the first to n-th extension audio streams having the PIDs in Fig. 5) to the PID filter 153. When, for example, TS packets of a video stream and of an audio stream are received by the receiving section 121, the input portion 151 acquires only the TS packets of the audio stream.

[0073]

The filter control portion 152 controls the operation of the PID filter 153 based on the acquired tables. Specifically, the filter control portion 152 remembers the type(s) of stream(s) that it can process, and the filter control portion 152 determines the type(s) of stream(s) that it can process based on the tables. The filter control portion 152 refers in the tables to the PID(s) of the stream(s) that it can process and controls the PID filter 153 so as to select the TS packets having the PID(s) associated with the stream(s) that it can process. For example, the filter control portion 152 informs the PID filter 153 of the value(s) of the PID(s) associated with the type(s) of decodable stream(s) as the value(s) of the PID(s) to be selected.

[0074]

Under the control of the filter control portion 152, the PID filter 153 selects (extracts) the TS packets. Specifically, the PID filter 153 selects, based on the PID(s) reported by the filter control portion 152, the TS packets having the same PID(s) and supplies the TS packets to the corresponding buffers. Each buffer stores (buffers) the TS packets selected by the PID filter 153. The audio decoder 155 acquires the TS packets stored in each buffer and decodes these TS packets.

[0075]

In the example of Fig. 11, the audio-stream processing section 122 has only the audio decoder 155 corresponding to the base audio stream and is incapable of decoding the first to n-th extension audio streams. In this case, the filter control portion 152 remembers that the type of stream that it can process is only the base audio stream, and the filter control portion 152 refers in the tables to the PID corresponding to the base audio stream. In this case, the audio-stream processing section 122 determines that BASE_PID is the type of stream that it can process and refers in the tables to PID = a0. The filter control portion 152 controls the PID filter 153 so as to select the TS packets having the PID of the decodable stream. For example, the filter control portion 152 informs the PID filter 153 of the ID of the decodable stream or the value of the PID to be passed through. Based on the PID, namely, PID = a0, reported by the filter control portion 152, the PID filter 153 selects the TS packets having PID = a0 and supplies the TS packets to the base buffer 154. When the TS packets of the first to n-th extension audio streams are supplied, the PID filter 153 does not select these packets. In other words, when only the TS packets of the base audio stream having PID = a0 are supplied, the PID filter 153 selects the TS packets and supplies the TS packets to the base buffer 154 at a subsequent stage.

[0076]

The base buffer 154 stores the TS packets of the base audio stream, which are selected and supplied by the PID filter 153. The base buffer 154 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 155. Although only one base buffer 154 is provided in the example of Fig. 11, two buffers may be provided in serial to serve as the base buffer 154, including a buffer for allowing synchronization of the TS packets at the receiving side and a buffer for allowing synchronization with the audio decoder 155. The audio decoder 155 decodes the TS packets of the base audio stream and outputs the decoded base audio stream.

[0077]

Next, a TS packet receiving process executed by the receiver 42 in Fig. 10 is described with reference to the flowchart of Fig. 12. This process is initiated when an instruction to receive the TS packets is given to the receiver 42.

[0078]

In step S51, the receiving section 121 of the receiver 42 receives TS packets (a stream including a plurality of TS packets). These TS packets are, for example, the TS packets transmitted by the transmitter 41 in step S19 of Fig. 6.

[0079]

In step S52, the receiving section 121 extracts the TS packets of the audio stream and supplies the TS packets to the audio-stream processing section 122. For example, when the TS packets received by the receiving section 121 include TS packets of a video stream, the receiving section 121 extracts only the TS packets of the audio stream and supplies the TS packets to the audio-stream processing section 122.

[0080]

In step S53, the audio-stream processing section 122 performs an audio stream processing process for decoding the TS packets of the audio stream (the audio stream including the plural TS packets) in accordance with the decoding capability of the audio-stream processing section 122. The details of the process are described with reference to Fig. 13. The audio stream processed by the audio-stream processing section 122 is supplied to the output section 123.

[0081]

In step S54, the output section 123 outputs the decoded audio stream to, for example, a speaker, which is not shown. After that, the process is finished.

[0082]

By the process in Fig. 12, the TS packets are received, and the TS packets of the audio stream are audio-stream processed (decoded) and output.

[0083]

Next, a base audio stream processing process, which is an example of step S53 of Fig. 12, is described with reference to the flowchart of Fig. 13. This process is a process executed by the audio-stream processing section 122 in Fig. 11. Specifically, this process is a process executed by the audio-stream processing section 122 that can decode only the base audio stream.

[0084]

In step S71, the input portion 151 receives input of the TS packets of the audio stream (the audio stream including the plural TS packets). The TS packets of the audio stream correspond to the audio stream including the TS packets of the tables, the TS packets of the base audio stream, and the TS packets of the first to n-th extension audio streams, which are transmitted by the transmitter 41 in step S19 of Fig. 6 described above.

[0085]

In step S72, the input portion 151 supplies the TS packets of the tables to the filter control portion 152. Specifically, since the TS packets of the audio stream include the TS packets of the tables, the TS packets of the base audio stream, and the TS packets of the first to n-th extension audio streams, the input portion 151 supplies, among these TS packets, the TS packets of the tables to the filter control portion 152.

[0086]

In step S73, the input portion 151 supplies the TS packets to which the PIDs are added to the PID filter 153. Specifically, in Fig. 5, the input portion 151 supplies the TS packets of the base audio stream and the TS packets of the first to n-th extension audio streams to which the PIDs are added to the PID filter 153.

[0087]

In step S74, the filter control portion 152 refers to the tables and determines the type(s) of stream(s) that the audio decoder 155 can process. Specifically, the filter control portion 152 remembers that the type of stream that it can process is the base audio stream and determines, based on the tables, the type of stream that it can process. The filter control portion 152 refers in the tables to the PID of the stream that it can process and controls the PID filter 153 so as to select the TS packets having PID = a0 associated with the base stream that it can process.

[0088]

In step S75, under the control of the filter control portion 152 (based on the determination), the PID filter 153 selects the corresponding TS packets and supplies the TS packets to the base buffer 154. Specifically, under the control of the filter control portion 152, the PID filter 153 selects the TS packets having PID = a0, i.e., the TS packets of the base audio stream, and supplies the TS packets to the base buffer 154.

[0089]

In step S76, the base buffer 154 stores the supplied TS packets. The TS packets stored here are the TS packets of the base audio stream.

[0090]

In step S77, the base buffer 154 outputs the TS packets to the audio decoder 155 with predetermined timing.

[0091]

In step S78, the audio decoder 155 decodes the supplied TS packets of the base audio stream and, in step S79, outputs the decoded audio stream.

[0092]

Since the PIDs are added to the TS packets and the relationships between the PIDs and the types of TS packets (TS packets of the base audio stream and the first to n-th extension audio streams) are written in the tables, even the audio-stream processing section 122 (the receiver 42) that can decode only the base audio stream, such as that shown in Fig. 11, can select and decode only the TS packets corresponding to the base audio stream. That is, even when the audio stream extended to a plurality of levels is transmitted, the receiver 42 having the audio-stream processing section 122 in Fig. 11 can extract only the base audio stream and plays back the base audio stream.

[0093]

Next, the audio-stream processing section 122 having an audio decoder that can decode the base audio stream and the first extension audio stream is described with reference to Fig. 14.

[0094]

Fig. 14 is a diagram showing an example of the configuration of the audio-stream processing section 122 including an audio decoder that can decode the base audio stream and the first extension audio stream. In this diagram, portions corresponding to those in Fig. 11 are referred to using the same reference numerals, and descriptions thereof are omitted to avoid repetition.

[0095]

The audio-stream processing section 122 in Fig. 14 includes, in addition to the audio-stream processing section 122 in Fig. 11, a first extension buffer 202. An audio decoder 203 can decode not only the base audio stream but also the first extension audio stream. The PID filter 153 can extract not only the base audio stream but also the first extension audio stream.

[0096]

The audio-stream processing section 122 in Fig. 14 includes the input portion 151, the filter control portion 152, a PID filter 201, the base buffer 154, the first extension buffer 202, and the audio decoder 203.

[0097]

The filter control portion 152 controls the operation of the PID filter 201 based on the tables. Specifically, the filter control portion 152 remembers the types of streams that it can process and determines, based on the tables, the types of streams that it can process. The filter control portion 152 refers in the tables to the PIDs of the streams that it can process and controls the PID filter 201 so as to select the TS packets having the PIDs associated with the streams that it can process. In the example of Fig. 14, the filter control portion 152 controls the PID filter 201 so as to supply the TS packets having PID = a0 to the base buffer 154 and the TS packets having PID = a1 to the first extension buffer 202. Under the control of the filter control portion 152, the PID filter 201 extracts the TS packets. In other words, the PID filter 201 selects the TS packets having PID = a0 and supplies the TS packets to the base buffer 154 and selects the TS packets having PID = a1 and supplies the TS packets to the first extension buffer 202.

[0098]

The base buffer 154 stores (buffers) the TS packets of the base audio stream, which are extracted by the PID filter 201, and the first extension buffer 202 stores the TS packets of the first extension audio stream, which are extracted by the PID filter 201. The audio decoder 203 acquires the TS packets stored in the base buffer 154 and the first extension buffer 202 and decodes the TS packets.

[0099]

In the example of Fig. 14, the audio-stream processing section 122 has the audio decoder 203 corresponding to the base audio stream and the first extension audio stream and is incapable of decoding the second to n-th extension audio streams. In this case, under the control of the filter control portion 152 (determination by the filter control portion 152), the PID filter 201 extracts the TS packets with PID = a0 and the TS packets with PID = a1. In other words, when the TS packets of the second to n-th extension audio streams are supplied, the PID filter 201 does not select these packets. When the TS packets of the base audio stream having PID = a0 are supplied, the PID filter 201 selects the packets and supplies the packets to the base buffer 154 at a subsequent stage. When the TS packets of the first extension audio stream having PID = a1 are supplied, the PID filter 201 selects the packets and supplies the packets to the first extension buffer 202 at a subsequent stage.

[0100]

The base buffer 154 stores the TS packets of the base audio stream (PID = a0), which are selected and supplied by the PID filter 201. The base buffer 154 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 203. The first extension buffer 202 stores the TS packets of the first extension audio stream (PID = a1), which are selected and supplied by the PID filter 201. The first extension buffer 202 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 203. Although one base buffer 154 and one extension buffer 202 are provided in the example of Fig. 14, two buffers may be provided in serial to serve as each buffer, including a buffer for allowing synchronization of the TS packets at the receiving side and a buffer for allowing synchronization with the audio decoder 203. The audio decoder 203 decodes the TS packets of the base audio stream and the TS packets of the first extension audio stream and outputs the decoded base audio stream and the decoded first extension audio stream.

[0101]

As described above, the receiver 42 (the audio-stream processing section 122 in Fig. 14) capable of decoding the base audio stream and the first extension audio stream can separate and play back only the base audio stream and the first extension audio stream.

[0102]

Next, the audio-stream processing section 122 having an audio decoder that can decode the base audio stream and the first and second extension audio streams is described with reference to Fig. 15.

[0103]

Fig. 15 is a diagram showing an example of the configuration of the audio-stream processing section 122 including an audio decoder that can decode the base audio stream and the first and second extension audio streams. In this diagram, portions corresponding to those in Figs. 11 and 14 are referred to using the same reference numerals, and descriptions thereof are omitted to avoid repetition.

[0104]

The audio-stream processing section 122 in Fig. 15 includes a first extension buffer 202-1 serving as the first extension buffer 202 in Fig. 14 and additionally includes a second extension buffer 202-2. An audio decoder 232 can decode not only the base audio stream and the first extension audio stream but also the second extension audio stream. A PID filter 231 can extract the base audio stream and the first and second extension audio streams.

[0105]

The audio-stream processing section 122 in Fig. 15 includes the input portion 151, the filter control portion 152, the PID filter 231, the base buffer 154, the first extension buffer 202-1, the second extension buffer 202-2, and the audio decoder 232.

[0106]

The filter control portion 152 remembers the types of streams that it can process and determines, based on the tables, the types of streams that it can process. The filter control portion 152 refers in the tables to the PIDs of the streams that it can process and controls the PID filter 201 so as to select the TS packets having the PIDs associated with the streams that it can process. In the example of Fig. 15, the filter control portion 152 performs control so as to supply the TS packets having PID = a0 to the base buffer 154, the TS packets having PID = a1 to the first extension buffer 202, and the TS packets having PID = a2 to the second extension buffer 202-2. Under the control of the filter control portion 152, the PID filter 231 extracts the TS packets. In other words, the PID filter 231 selects the TS packets having PID = a0 and supplies the TS packets to the base buffer 154, selects the TS packets having PID = a1 and supplies the TS packets to the first extension buffer 202-1, and selects the TS packets having PID = a2 and supplies the TS packets to the second extension buffer 202-2.

[0107]

The second extension buffer 202-2 stores the TS packets of the second extension audio stream, which are selected by the PID filter 231. The audio decoder 232 acquires the TS packets stored in the base buffer 154 and the first and second extension buffers 202-1 and 202-2 and decodes the TS packets.

[0108]

In the example of Fig. 15, the audio-stream processing section 122 has the audio decoder 232 corresponding to the base audio stream and the first and second extension audio streams and is incapable of decoding the third to n-th extension audio streams. In this case, under the control of the filter control portion 152, the PID filter 231 extracts (selects) the TS packets with PID = a0, the TS packets with PID = a1, and the TS packets with PID = a2. In other words, when the TS packets of the third to n-th extension audio streams are supplied, the PID filter 231 does not select these packets. When the TS packets of the base audio stream having PID = a0 are supplied, the PID filter 231 selects the packets and supplies the packets to the base buffer 154 at a subsequent stage. When the TS packets of the first extension audio stream having PID = a1 are supplied, the PID filter 231 selects the packets and supplies the packets to the first extension buffer 202-1 at a subsequent stage. When the TS packets of the second extension audio stream having PID = a2 are supplied, the PID filter 231 selects the packets and supplies the packets to the second extension buffer 202-2 at a subsequent stage.

[0109]

The base buffer 154 stores the TS packets of the base audio stream (PID = a0), which are selected and supplied by the PID filter 231. The base buffer 154 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 232. The first extension buffer 202-1 stores the TS packets of the first extension audio stream (PID = a1), which are selected and supplied by the PID filter 231. The first extension buffer 202-1 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 232. The second extension buffer 202-2 stores the TS packets of the second extension audio stream (PID = a2), which are selected and supplied by the PID filter 231. The first extension buffer 202-2 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 232.

[0110]

Although one base buffer 154, one extension buffer 202-1, and one extension buffer 202-2 are provided in the example of Fig. 15, two buffers may be provided in serial to serve as each buffer, including a buffer for allowing synchronization of the TS packets at the receiving side and a buffer for allowing synchronization with the audio decoder 232. The audio decoder 232 decodes the TS packets of the base audio stream and the TS packets of the first and second extension audio streams and outputs the decoded base audio stream and the decoded first and second extension audio streams.

[0111]

As described above, the receiver 42 (the audio-stream processing section 122 in Fig. 15) capable of decoding the base audio stream and the first and second extension audio streams can separate and play back the base audio stream and the first and second extension audio streams.

[0112]

Next, the audio-stream processing section 122 having an audio decoder that can decode the base audio stream and the first to n-th extension audio streams is described with reference to Fig. 16.

[0113]

Fig. 16 is a diagram showing an example of the configuration of the audio-stream processing section 122 including an audio decoder that can decode the base audio stream and the first to n-th extension audio streams. In this diagram, portions corresponding to those in Fig. 15 are referred to using the same reference numerals, and descriptions thereof are omitted to avoid repetition.

[0114]

The audio-stream processing section 122 in Fig. 16 includes, in addition to Fig. 15, third to n-th extension buffers 202-3 to 203-n. An audio decoder 262 can decode not only the base audio stream and the first and second extension audio streams but also the third to n-th extension audio streams. A PID filter 261 can extract the base audio stream and even the first to n-th extension audio streams.

[0115]

The audio-stream processing section 122 in Fig. 16 includes the input portion 151, the filter control portion 152, the PID filter 261, the base buffer 154, the first to n-th extension buffers 202-1 to 202-n, and the audio decoder 262.

[0116]

The filter control portion 152 remembers that the base audio stream and the first to n-th extension audio streams are the types of streams that it can process. Based on the tables, the filter control portion 152 determines the types of streams that it can process. The filter control portion 152 refers in the tables to the PIDs of the streams that it can process and controls the PID filter 261 so as to select the TS packets having the PIDs associated with the streams that it can process. In the example of Fig. 16, the filter control portion 152 controls the PID filter 261 so as to supply the TS packets having PID = a0 to the base buffer 154, the TS packets having PID = a1 to the first extension buffer 202-1, the TS packets having PID = a2 to the second extension buffer 202-2, and similarly the TS packets having PID = aN to the n-th extension buffer 202-n. Under the control of the filter control portion 152, the PID filter 261 extracts the TS packets. In other words, the PID filter

261 selects the TS packets having PID = a0 and supplies the TS packets to the base buffer 154; selects the TS packets having PID = a1 and supplies the TS packets to the first extension buffer 202-1; selects the TS packets having PID = a2 and supplies the TS packets to the second extension buffer 202-2; and similarly selects the TS packets having PID = aN and supplies the TS packets to the n-th extension buffer 202-n.

[0117]

The third to n-th extension buffers 202-3 to 202-n store the corresponding TS packets of the third to n-th extension audio streams, which are extracted by the PID filter 261. The audio decoder 262 acquires the TS packets stored in the base buffer 154 and the first to n-th extension buffers 202-1 to 202-n and decodes the TS packets.

[0118]

In the example of Fig. 16, the audio-stream processing section 122 has the audio decoder 262 corresponding to the base audio stream and the first to n-th extension audio streams, and, that is to say, is capable of decoding all the received extension audio streams up to the n-th level. In this case, under the control of the filter control portion 152, the PID filter 261 extracts the TS packets with PIDs = a0 to aN and supplies these TS packets to the corresponding buffers (the base buffer 154 and the first to n-th extension buffers 202-1 to 202-n).

[0119]

The base buffer 154 stores the TS packets of the base audio stream (PID = a0), which are selected and supplied by the PID filter 261. The base buffer 154 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 262. The first extension buffer 202-1 stores the TS packets of the first extension audio stream (PID = a1), which are selected and supplied by the PID filter 261. The first extension buffer 202-1 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 262. The second extension buffer 202-2 stores the TS packets of the second extension audio stream (PID = a2), which are selected and supplied by the PID filter 261. The first extension buffer 202-2 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 262. Similarly the n-th extension buffer 202-n stores the TS packets of the n-th extension audio stream (PID = aN), which are selected and supplied by the PID filter 261. The first extension buffer 202-n operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 262. Although each of the base buffer 154 and the first to n-th extension buffers 202-1 to 202-n is provided in the example of Fig. 16, two buffers may be provided in serial to serve as each buffer, including a buffer for allowing synchronization of the TS packets at the receiving side and a buffer for allowing synchronization with the audio decoder 262. The audio decoder 262 decodes the TS packets of the base audio stream and the TS packets of the first to n-th extension audio streams and outputs the decoded base audio stream and the decoded first to n-th extension audio streams.

[0120]

Next, an n-th audio stream processing process, which is an example of step S53 in Fig. 12, is described with reference to the flowchart of Fig. 17. This process is a process executed by the audio-stream processing section 122 in Fig. 16. Specifically, this process is a process executed by the audio-stream processing section 122 that can decode, in addition to the base audio stream, the first to n-th extension audio streams.

[0121]

In step S91, the input portion 151 receives input of the TS packets of the audio stream (the audio stream including the plural TS packets). The TS packets of the audio stream correspond to the audio stream including the TS packets of the tables, the TS packets of the base audio stream, and the TS packets of the first to n-th extension audio streams, which are transmitted by the transmitter 41 in step S19 of Fig. 6 described above.

[0122]

In step S92, the input portion 151 supplies the TS packets of the tables to the filter control portion 152. Specifically, since the TS packets of the audio stream include the TS packets of the tables, the TS packets of the base audio stream, and the TS packets of the first to n-th extension audio streams, the input portion 151 supplies, among these TS packets, the TS packets of the tables to the filter control portion 152.

[0123]

In step S93, the input portion 151 supplies the TS packets to which the PIDs are added to the PID filter 261. Specifically, in Fig. 5, the input portion 151 supplies the TS packets of the base audio stream and the first to n-th extension audio streams to which the PIDs are added to the PID filter 261.

[0124]

In step S94, the filter control portion 152 refers to the tables and determines the types of streams that the audio decoder 262 can process. Specifically, the filter control portion 152 remembers that the types of streams that it can process are the base audio stream and the first to n-th extension audio streams and determines, based on the tables, the types of streams that it can process. That is, the filter control portion 152 determines, from the tables, the base audio stream and the first to n-th extension audios streams. In other words, the filter control portion 152 refers to the tables and determines the types of streams that it can process and determines the PIDs associated with these streams as the types of streams that it can process. The filter control portion 152 controls the PID filter 153 so as to select the TS packets having PID = a0 associated with the base stream and the TS packets having PID = a1 to aN associated with the first to n-th extension audio streams.

[0125]

As described above, the filter control portion 152 controls the PID filter 261 so as to supply the TS packets of the base audio stream and the TS packets of the first to n-th extension audio streams to the base buffer 154 and the first to n-th extension buffers 202-1 to 202-n, respectively. Since in the process in Fig. 17 the audio decoder 262 is capable of decoding the base audio stream and the first to n-th extension audio streams, the filter control portion 152 controls the PID filter 261 so as to supply the TS packets having PID = a0, a1, a2, ..., aN to the corresponding buffers.

[0126]

In step S95, based on the determination by the filter control portion 152 (the types of streams determined to be processable), the PID filter 261 selects a switch and supplies the corresponding TS packets to the buffers at a subsequent stage. Specifically, the PID filter 261 uses the switch to select the TS packets having PID = a0, namely, the TS packets of the base audio stream, and supplies the TS packets to the base buffer 154 at a subsequent stage. In addition, the PID filter 261 uses the switch to select the TS packets having PID = a1 to aN, namely, the TS packets of the first to n-th extension audio streams and supplies these TS packets to the corresponding first to n-th extension buffers 202-1 to 202-n at a subsequent stage.

[0127]

In step S96, the base buffer 154 and the first to n-th extension buffers 202-1 to 202-n store the supplied TS packets, respectively.

[0128]

In step S97, the base buffer 154 and the first to n-th extension buffers 202-1 to 202-n output the TS packets to the audio decoder 262 with predetermined timing.

[0129]

In step S98, the audio decoder 262 decodes the supplied TS packets of the base audio stream and, in step S99, outputs the decoded audio stream.

[0130]

As described above, the received stream includes the TS packets forming the base audio stream, the TS packets forming the first to n-th extension audio streams, and the TS packets of the tables in which information is written for associating the PIDs that respectively identify these TS packets with the base audio stream and the first to n-th extension audio streams. Since the PIDs that identify the types of audio streams are added to the TS packets forming the base audio stream and the TS packets forming the first to n-th extension audio streams, the audio-stream processing section 122 (the receiver 42) capable of decoding the base audio stream and the first to n-th extension audio streams, such as that shown in Fig. 17, can perform decoding.

[0131]

The receiver 42 capable of decoding the base audio stream and the first to m-th extension audio streams (m represents a natural number greater than or equal to one and less than or equal to n) can separate and play back the base audio stream and the first to m-th extension audio streams.

[0132]

Next, another example of the configuration of the receiver 42 including the audio-stream processing section 122 capable of decoding the base audio stream and the first to n-th extension audio streams is described. Fig. 18 is a diagram showing an example of the configuration of the audio-stream processing section 122 decoding the base audio stream and the first to n-th extension audio streams.

[0133]

The audio-stream processing section 122 in Fig. 18 is limited in the TS multiplexing. Specifically, it is necessary that, in a TS, encoding units to be synchronously played back be encoded in sequence in the order of the base audio stream and the first to n-th extension audio streams. That is, in a TS, encoding units need to be encoded in sequence in the order of BS(1), Ext1(1), Ext2(1), ... ExtN(1), BS(2), Ext2(2), ... ExtN(2). In other words, the TS packets received by the receiving section 121 of the receiver 42 are input to the input portion 151 in the order of BS(1), Ext1(1), Ext2(1), ... ExtN(1), BS(2), Ext2(2), ... ExtN(2), and the input portion 151 supplies the TS packets in the order of BS(1), Ext1(1), Ext2(1), ... ExtN(1), BS(2), Ext2(2), ... ExtN(2) to a PID filter 301.

[0134]

The audio-stream processing section 122 in Fig. 18 includes the input portion 151, the filter control portion 152, the PID filter 301, a buffer 302, and an audio decoder 303.

[0135]

The filter control portion 152 controls the PID filter 301 so as to supply the TS packets having PID = a0 to aN to the buffer 302. Under the control of the filter control portion 152, the PID filter 301 extracts the TS packets. In other words, the PID filter 301 sequentially supplies the TS packets having PID = a0 to aN to the buffer 302. Since the TS packets in the TS are encoded in sequence in the order of BS(1), Ext1(1), Ext2(1), ... ExtN(1), BS(2), Ext2(2), ... ExtN(2), the PID filter 301 supplies the TS packets in the TS in the order of BS(1), Ext1(1), Ext2(1), ... ExtN(1), BS(2), Ext2(2), ... ExtN(2) to the buffer 302.

[0136]

The buffer 302 stores the TS packets supplied in sequence in the order of BS(1), Ext1(1), Ext2(1), ... ExtN(1), BS(2), Ext2(2), ... ExtN(2). The audio decoder 303 acquires the TS packets stored in the buffer 302 and decodes the TS packets.

[0137]

In the example of Fig. 18, the audio-stream processing section 122 has the audio decoder 303 corresponding to the base audio stream and the first to n-th extension audio streams and thus is capable of decoding all of the received base audio stream and the first to n-th extension audio streams. In this case, under the control of the filter control portion 152, the PID filter 301 extracts the TS packets with PID = a0 to aN and supplies these TS packets to the buffer 302.

[0138]

The buffer 302 stores the TS packets of the audio stream (PID = a0 to aN), which are sequentially selected and supplied by the PID filter 301. The buffer 302 operates to allow synchronization of the TS packets at the receiving side and synchronization with the audio decoder 303. Although one buffer 302 is provided in the example of Fig. 18, two buffers may be provided in serial to serve as the buffer 302, including a buffer for allowing synchronization of the TS packets at the receiving side and a buffer for allowing synchronization with the audio decoder 303. The audio decoder 303 sequentially decodes the TS packets of the base audio stream and the TS packets of the first to n-th extension audio streams and outputs the decoded base audio stream and the decoded first to n-th extension audio streams.

[0139]

According to Fig. 18, the number of buffers is reduced compared with that in Fig. 16, thereby achieving lower cost. Although the number of buffers in Fig. 16 is greater than that in Fig. 18, it is advantageous in that the order of encoding TS packets is not limited.

[0140]

According to the embodiment, in the case where a multiplexed stream including the base audio stream and extension audio streams at a plurality of levels is played back, there is provided a multiplexed stream encoding and decoding method for the receiver 42 capable of decoding only the base audio stream (e.g., the receiver 42 having the audio-stream processing section 122 in Fig. 11) that separates and plays back only the base audio stream; and for the playback apparatus 42 capable of playing back the extension audio streams up to a predetermined n-th level (e.g., the receiver 42 having the audio-stream processing section 122 in Fig. 16) that separates and plays back the base audio stream and the extension audio streams up to the n-th level.

[0141]

That is, a stream including the base audio stream and extension streams at a plurality of levels can be encoded so as to be decodable in accordance with the processing capacity of the receiving side. In other words, when a stream including the base audio stream and extension streams at a plurality of levels is transmitted, an apparatus at the receiving side can determine the types of streams that it can process and can decode and play back only the streams that it can process.

[0142]

Since it is only necessary to add the PID to each TS packet and to add the tables, this method is easily applicable to a transport stream.

[0143]

Since only one type of stream needs to be included in one TS packet having 188 bytes, which is relatively a small amount of data, that is, the base audio stream and the extension audio stream(s) need not be included in one TS packet, encoding with high encoding efficiency can be performed.

[0144]

Because the stream structure is not defined by the format, even when an extension is added to an audio stream, that is, even when n is increased, both encoding and decoding in accordance therewith can be performed. That is, even an apparatus capable of decoding only the base audio stream can decode an audio stream to which extension is added.

[0145]

The present invention is not limited to the transmitter 41 having an encoder and is applicable to all the information processing apparatuses that perform encoding. Also, the present invention is not limited to the receiver 42 having a decoder and is applicable to all the information processing apparatuses that perform decoding.

[0146]

In the above examples, the cases in which the present invention is applied to encoding and decoding of an audio stream have been described. However, the present invention is not limited thereto but can be applied to encoding and decoding of a video stream. In other words, the present invention can be applied to a stream such as an audio stream or a video stream.

[0147]

The above-described consecutive processing can be executed by hardware or can be executed by software. In this case, the above-described processing is executed by a personal computer 500 shown in Fig. 20.

[0148]

In Fig. 20, a CPU 501 executes various types of processing in accordance with programs stored in a ROM 502 or programs loaded from a storage section 508 to a RAM 503. The RAM 503 stores the data required for the CPU 501 to execute various types of processing.

[0149]

The CPU 501, the ROM 502, and the RAM 503 are connected to one another via an internal bus 504. The internal bus 504 also connects to an input/output interface 505.

[0150]

The input/output interface 505 connects to an input section 506 including a keyboard and a mouse; an output section 507 including a display formed by a CRT, an LCD, or the like, and a speaker; a storage section 508 including a hard disk; and a communication section 509 including a modem and a terminal adapter. The communication section 509 performs communicating processing via various types of networks including a telephone line and a CATV.

[0151]

The input/output interface 505 connects to a drive 510, if necessary, and a removable medium 521, such as a magnetic disk, an optical disc, a magneto-optical disc, or a semiconductor memory, is loaded into the drive 510. A computer program read therefrom is installed in the storage section 508, if necessary.

[0152]

When the consecutive processing is executed by software, programs forming the software are installed from a network or a recording medium.

[0153]

As shown in Fig. 20, the recording medium includes a package medium which includes the program-recorded removable medium 521 distributed for providing a user with a program, but also a hard disk which includes the program-recorded ROM 502 and the program-recorded storage section 508 provided to the user in a form built into an apparatus.

[0154]

In this specification, steps constituting a computer program include, needless to say, processing steps which are performed in a time-series manner in the order given, and include processing steps which are executed in parallel or separately even if they are not always executed in a time-series manner.

[0155]

In addition, in this specification, the system means the entirety of an apparatus including a plurality of devices.

[Brief Description of the Drawings]

[0156]

[Fig. 1] Fig. 1 is an illustration of the structure of a program stream in the DVD video format.

[Fig. 2] Fig. 2 is a diagram showing an example of the configuration of the entirety of a transmitting/receiving system to which the present invention is applied.

[Fig. 3] Fig. 3 is a block diagram showing an example of the configuration of a transmitter in Fig. 2.

[Fig. 4] Fig. 4 is an illustration of the structure of a TS in which a base audio stream and extension audio streams at a plurality of levels are multiplexed.

[Fig. 5] Fig. 5 is an illustration of the structure of the TS in which the base audio stream and the extension audio streams at a plurality of levels are multiplexed.

[Fig. 6] Fig. 6 is a flowchart illustrating a TS packet transmitting process executed by the transmitter in Fig. 3.

[Fig. 7] Fig. 7 is an illustration of a table.

[Fig. 8] Fig. 8 is an illustration of a table.

[Fig. 9] Fig. 9 is a flowchart illustrating a TS packet generating process.

[Fig. 10] Fig. 10 is a block diagram showing an example of the configuration of a receiver in Fig. 2.

[Fig. 11] Fig. 11 is an illustration of an example of the configuration of an audio-stream processing section that can decode only the base audio stream.

[Fig. 12] Fig. 12 is a flowchart showing a TS packet receiving process executed by the receiver in Fig. 10.

[Fig. 13] Fig. 13 is a flowchart showing an audio stream processing process executed by the audio-stream processing section in Fig. 11.

[Fig. 14] Fig. 14 is an illustration of an example of the configuration of an audio-stream processing section that can decode the base audio stream and the first extension audio stream.

[Fig. 15] Fig. 15 is an illustration of an example of the configuration of an audio-stream processing section that can decode the base audio stream and the first and second extension audio streams.

[Fig. 16] Fig. 16 is an illustration of an example of the configuration of an audio-stream processing section that can decode the base audio stream and the first to n-th extension audio streams.

[Fig. 17] Fig. 17 is a flowchart showing an audio stream processing process executed by the audio-stream processing section in Fig. 16.

[Fig. 18] Fig. 18 is an illustration of an example of the configuration of the audio-stream processing section that can decode the base audio stream and the first to n-th extension audio streams.

[Fig. 19] Fig. 19 is an illustration of the order of TS packets.

[Fig. 20] Fig. 20 is a diagram showing a personal computer.

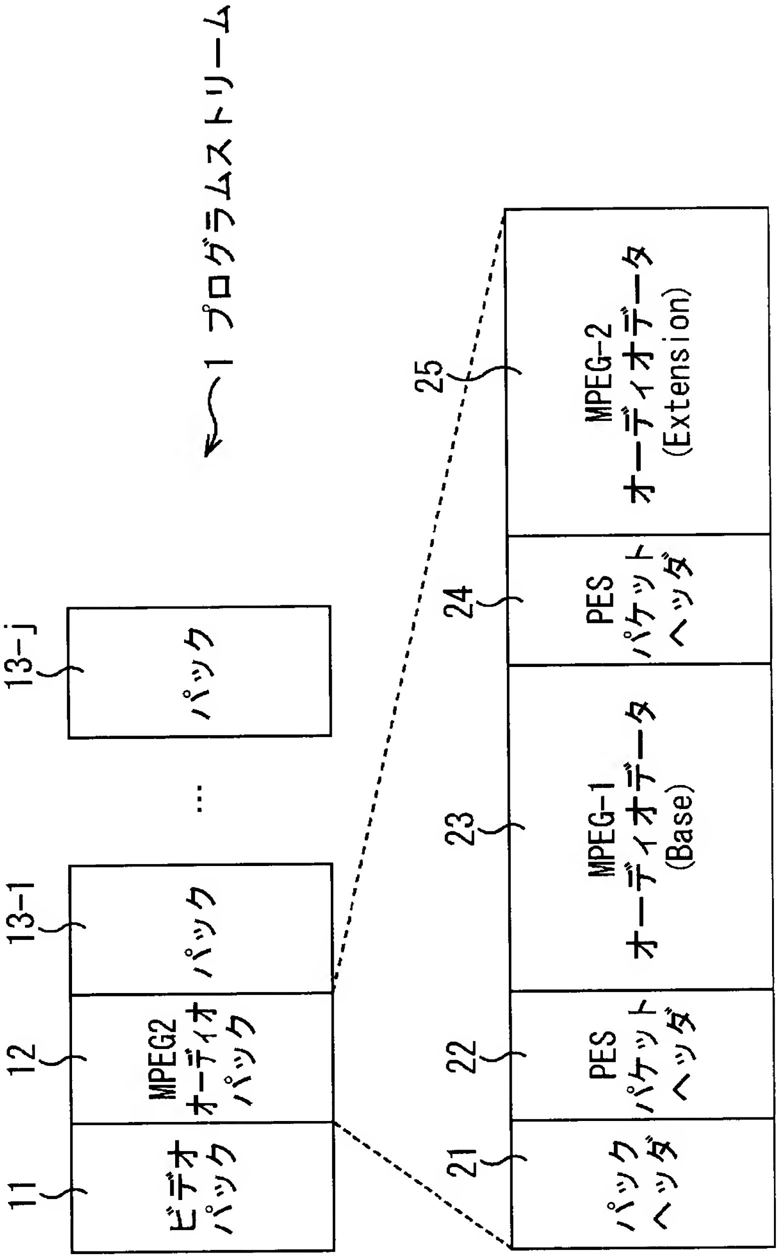
[Reference Numerals]

[0157]

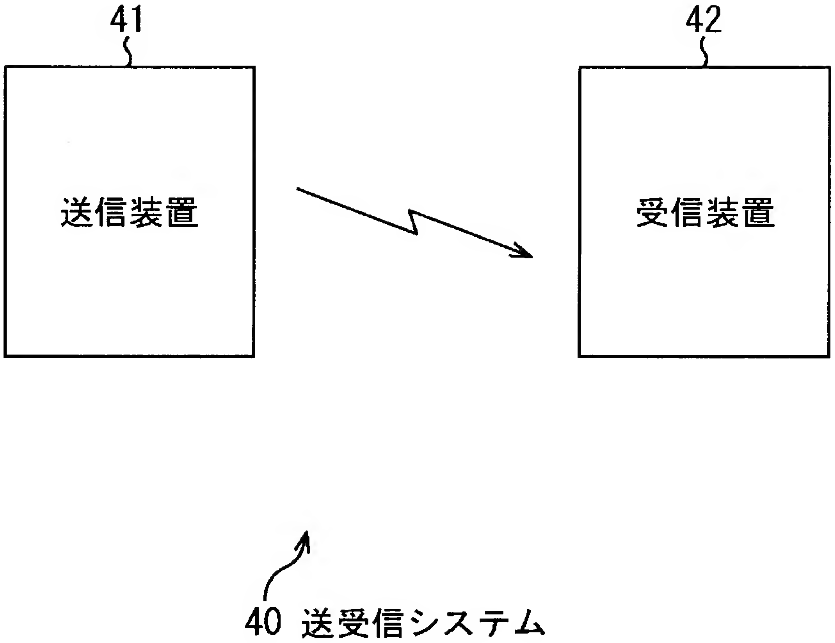
40 transmitting/receiving system, 41 transmitter, 42 receiver, 71 input section, 72 audio encoder, 73 base buffer, 74-1 to 74-n extension buffers, 76 TS packetizing section, 77 transmitting section, 90 to 92, and 93-1 to 93-n TS packet, 121 receiving section, 122 audio-stream processing section, 123 output section, 151 input portion, 152 filter control portion, 153 PID filter, 154 base buffer, 155 audio decoder, 201 PID filter, 202 extension buffer, 203 audio decoder, 231 PID filter, 232 audio decoder, 261 PID filter, 262 audio decoder, 301 PID filter, 302 buffer, 303 audio

decoder

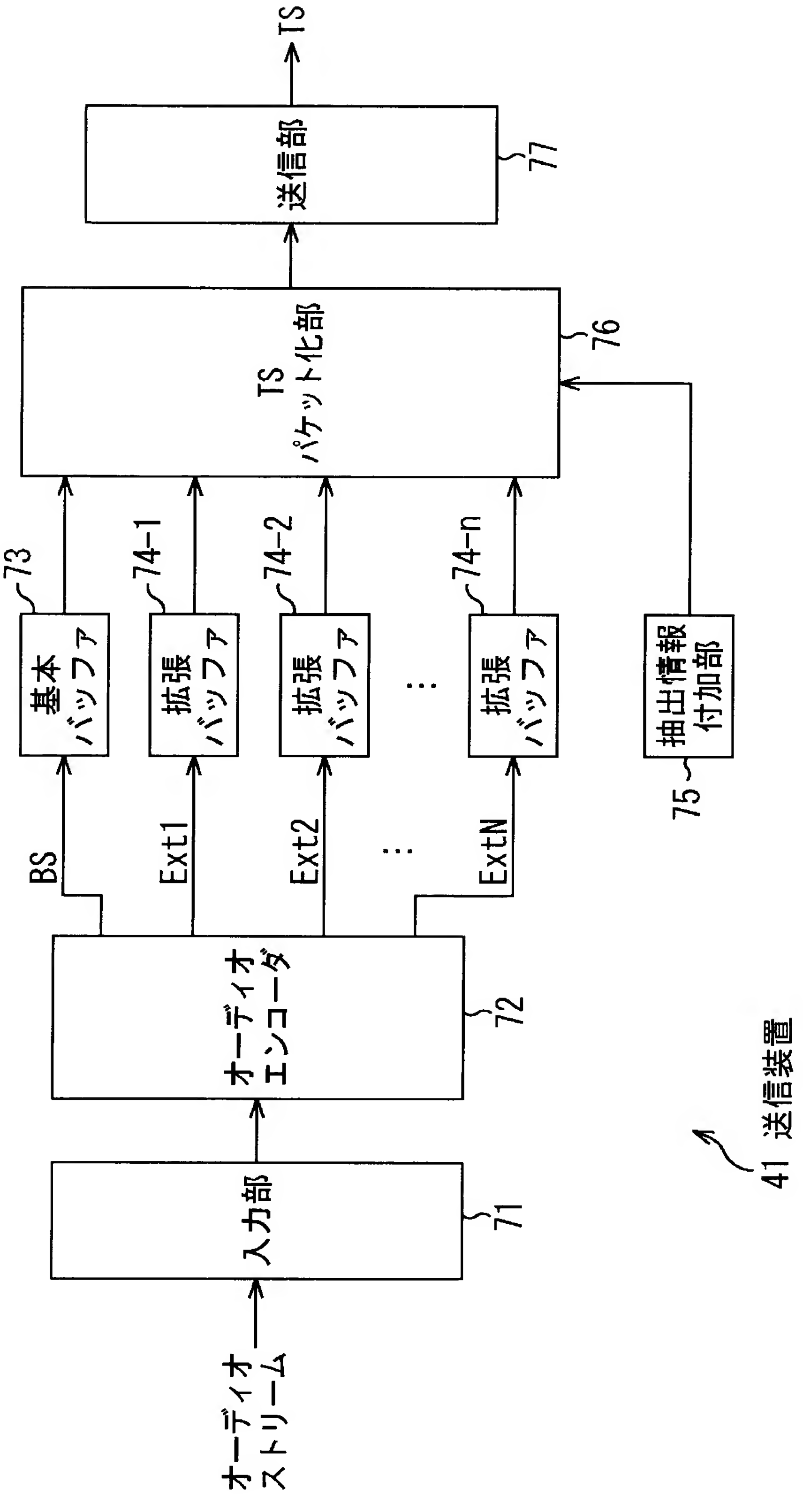
【書類名】図面
【図１】
図1


1 プログラムストリーム
11
ビデオパック
12
MPEG2 オーディオパック
13-1
パック
…
13-j
パック
21
パックヘッダ
22
PES パケットヘッダ
23
MPEG-1 オーディオデータ (Base)
24
PES パケットヘッダ
25
MPEG-2 オーディオデータ (Extension)

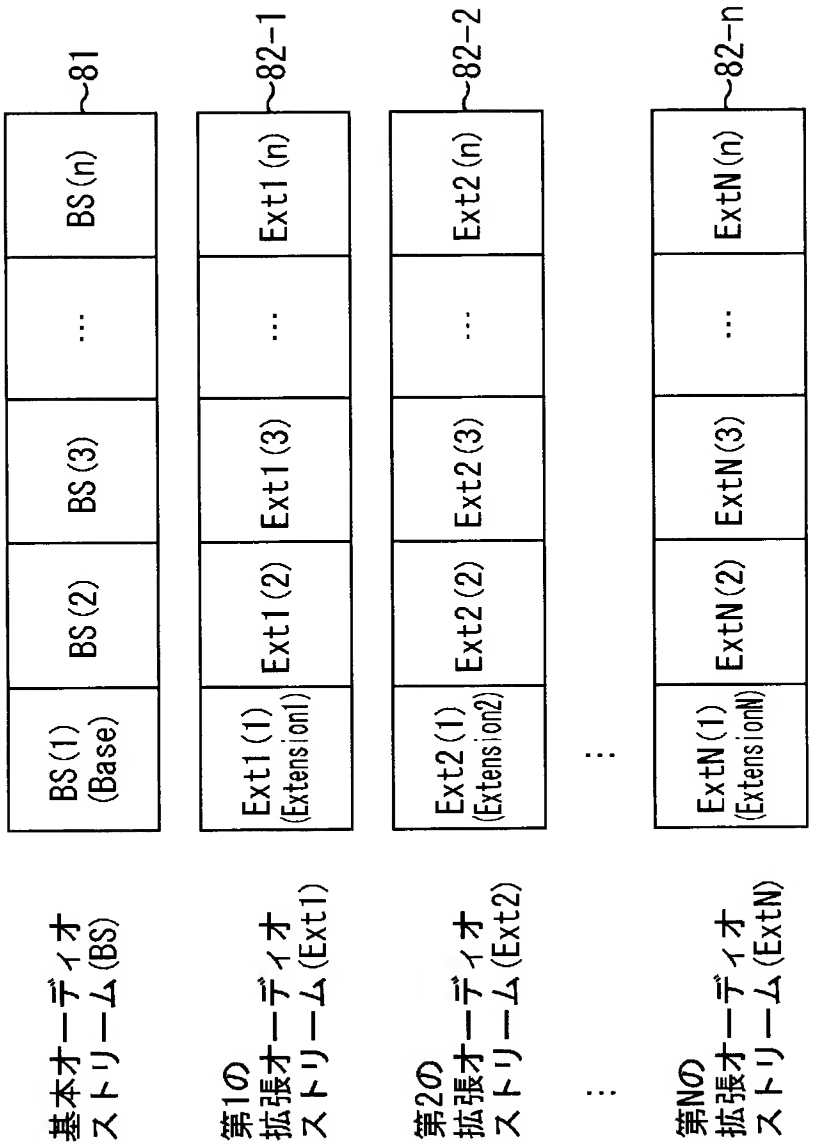
【図２】
図2


41
送信装置
42
受信装置
40 送受信システム

【図３】
図3

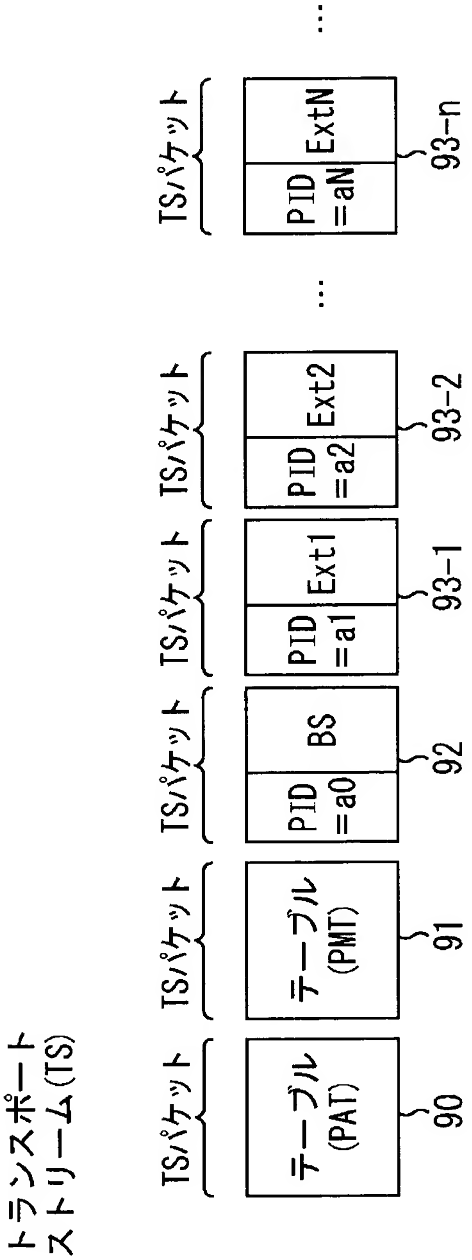

オーディオ
ストリーム
入力部
71
オーディオ
エンコーダ
72
BS
Ext1
Ext2
…
ExtN
基本
バッファ
73
拡張
バッファ
74-1
拡張
バッファ
74-2
…
拡張
バッファ
74-n
抽出情報
付加部
75
TS
パケット化部
76
送信部
77
TS
41 送信装置

【図４】
図4



基本オーディオストリーム(BS)
BS(1) (Base)
BS(2)
BS(3)
…
BS(n)
~81
第1の拡張オーディオストリーム(Ext1)
Ext1(1) (Extension1)
Ext1(2)
Ext1(3)
…
Ext1(n)
~82-1
第2の拡張オーディオストリーム(Ext2)
Ext2(1) (Extension2)
Ext2(2)
Ext2(3)
…
Ext2(n)
~82-2
…
第Nの拡張オーディオストリーム(ExtN)
ExtN(1) (ExtensionN)
ExtN(2)
ExtN(3)
…
ExtN(n)
~82-n

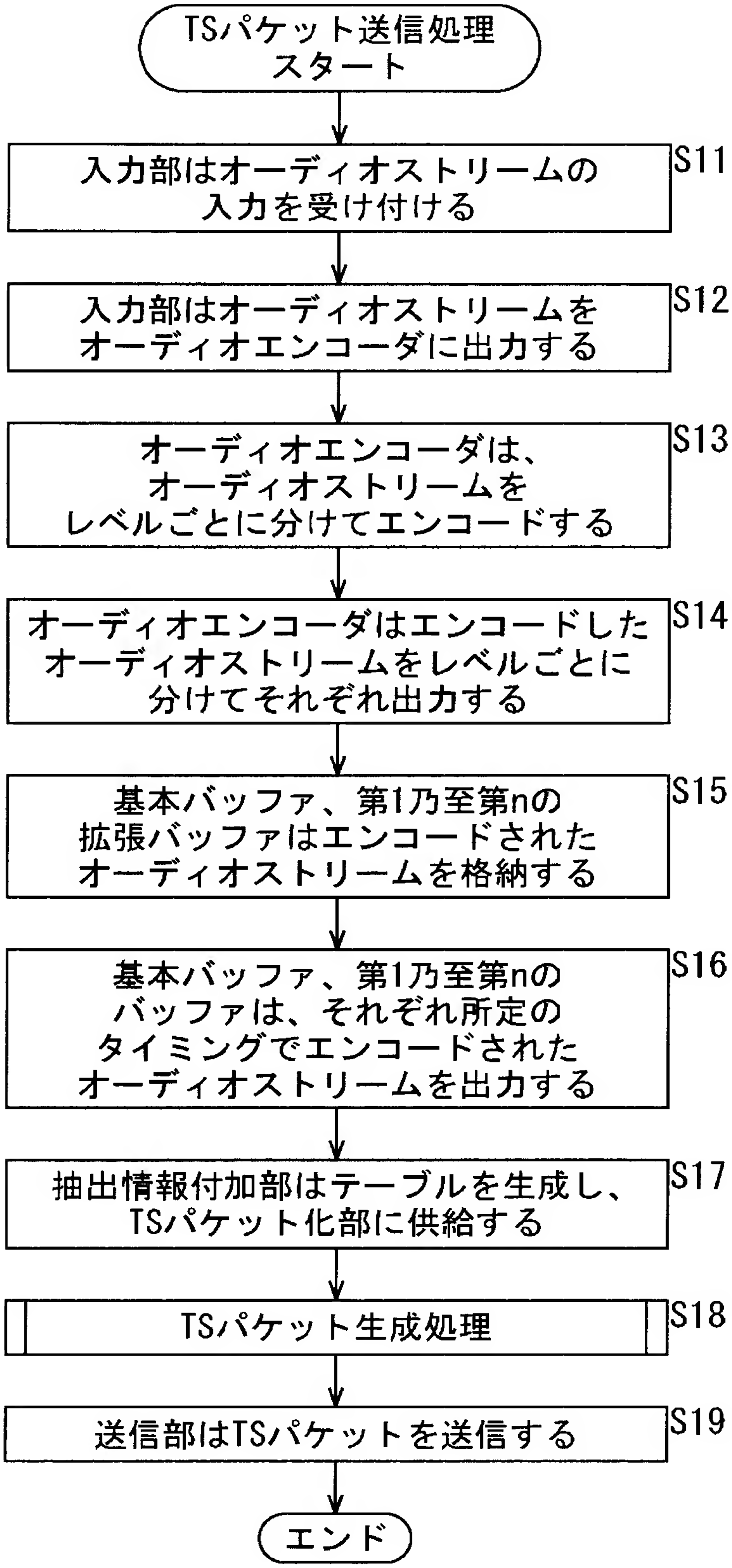
【図５】
図5



トランスポートストリーム(TS)
TSパケット
テーブル (PAT)
90
TSパケット
テーブル (PMT)
91
TSパケット
PID =a0
BS
92
TSパケット
PID =a1
Ext1
93-1
TSパケット
PID =a2
Ext2
93-2
…
TSパケット
PID =aN
ExtN
93-n
…

【図６】

図6


TSパケット送信処理
スタート
入力部はオーディオストリームの入力を受け付ける
S11
入力部はオーディオストリームをオーディオエンコーダに出力する
S12
オーディオエンコーダは、オーディオストリームをレベルごとに分けてエンコードする
S13
オーディオエンコーダはエンコードしたオーディオストリームをレベルごとに分けてそれぞれ出力する
S14
基本バッファ、第1乃至第nの拡張バッファはエンコードされたオーディオストリームを格納する
S15
基本バッファ、第1乃至第nのバッファは、それぞれ所定のタイミングでエンコードされたオーディオストリームを出力する
S16
抽出情報付加部はテーブルを生成し、TSパケット化部に供給する
S17
TSパケット生成処理
S18
送信部はTSパケットを送信する
S19
エンド

【図７】
図7

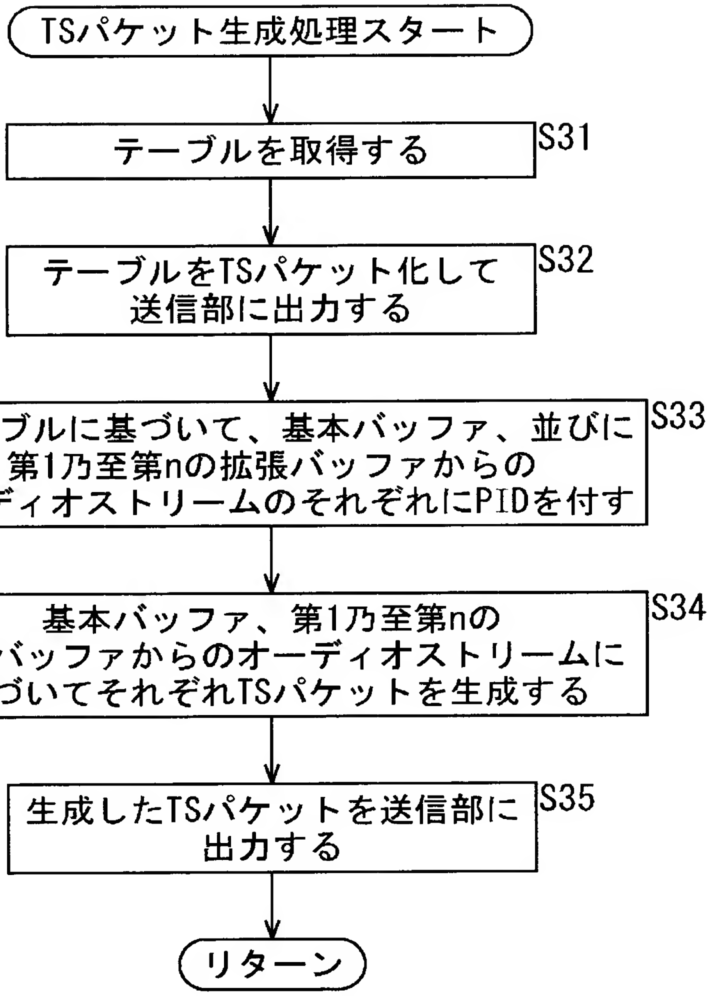
```
Program Association Table(PAT){
    program_entry{
          program_number PMT_PID{
                 1         X
    }            2         Y
}
```

【図８】
図8

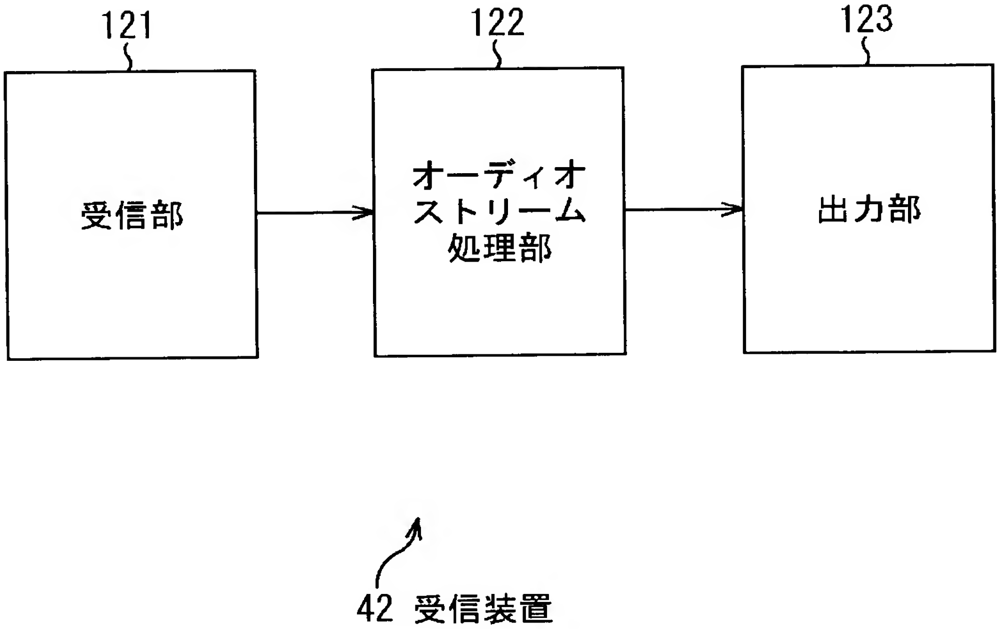
```
Program Map Table(PMT){
    PID     X
    stream_entry(){
         BASE_PID a0
         Ext1_PID a1
         Ext2_PID a2
             ⋮
         ExtN_PID aN
    }
}
```

【図９】

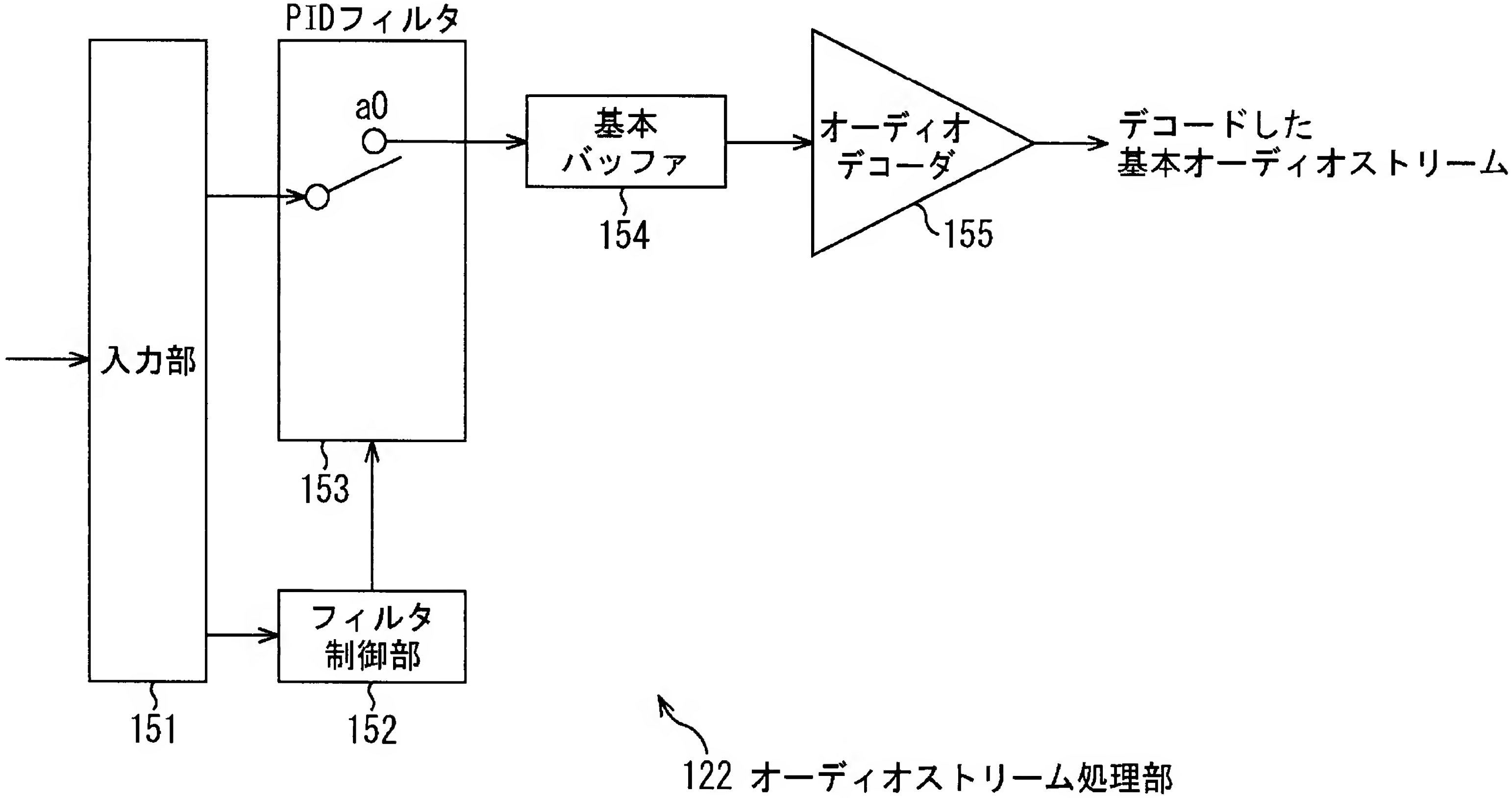
図9


TSパケット生成処理スタート
テーブルを取得する
S31
テーブルをTSパケット化して送信部に出力する
S32
テーブルに基づいて、基本バッファ、並びに第1乃至第nの拡張バッファからのオーディオストリームのそれぞれにPIDを付す
S33
基本バッファ、第1乃至第nの拡張バッファからのオーディオストリームに基づいてそれぞれTSパケットを生成する
S34
生成したTSパケットを送信部に出力する
S35
リターン

【図１０】
図10


121
受信部
122
オーディオ
ストリーム
処理部
123
出力部
42 受信装置

【図１１】
図11


PIDフィルタ
a0
基本
バッファ
オーディオ
デコーダ
デコードした
基本オーディオストリーム
入力部
154
155
153
フィルタ
制御部
151
152
122 オーディオストリーム処理部

【図１２】

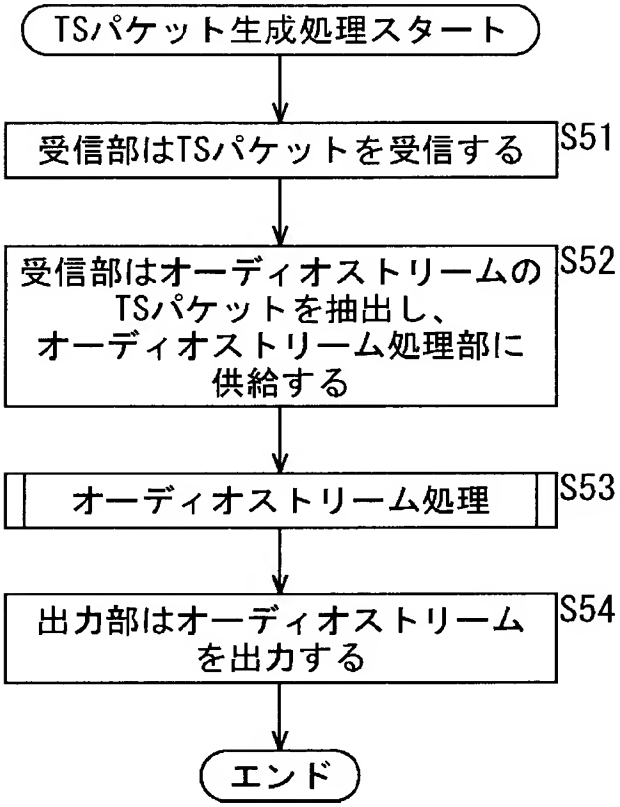
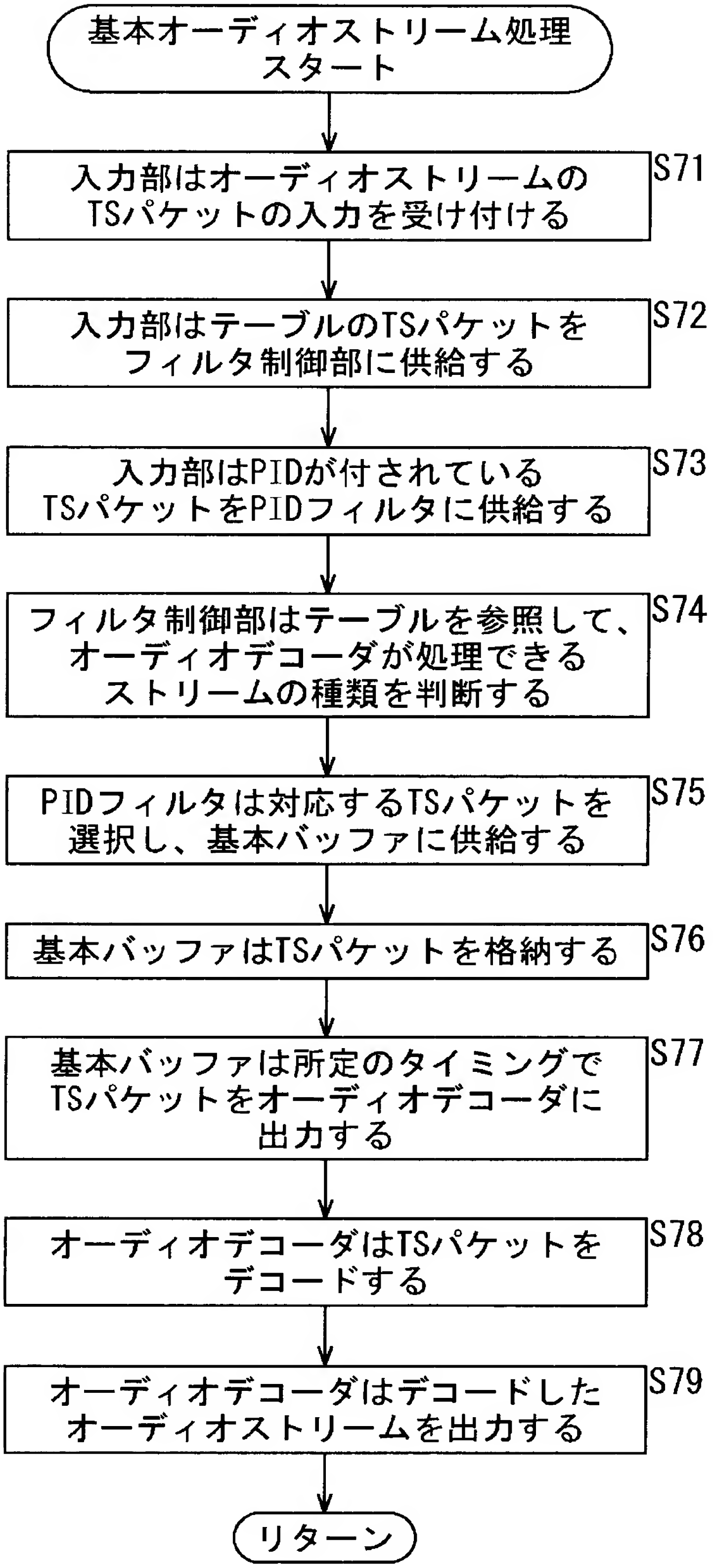
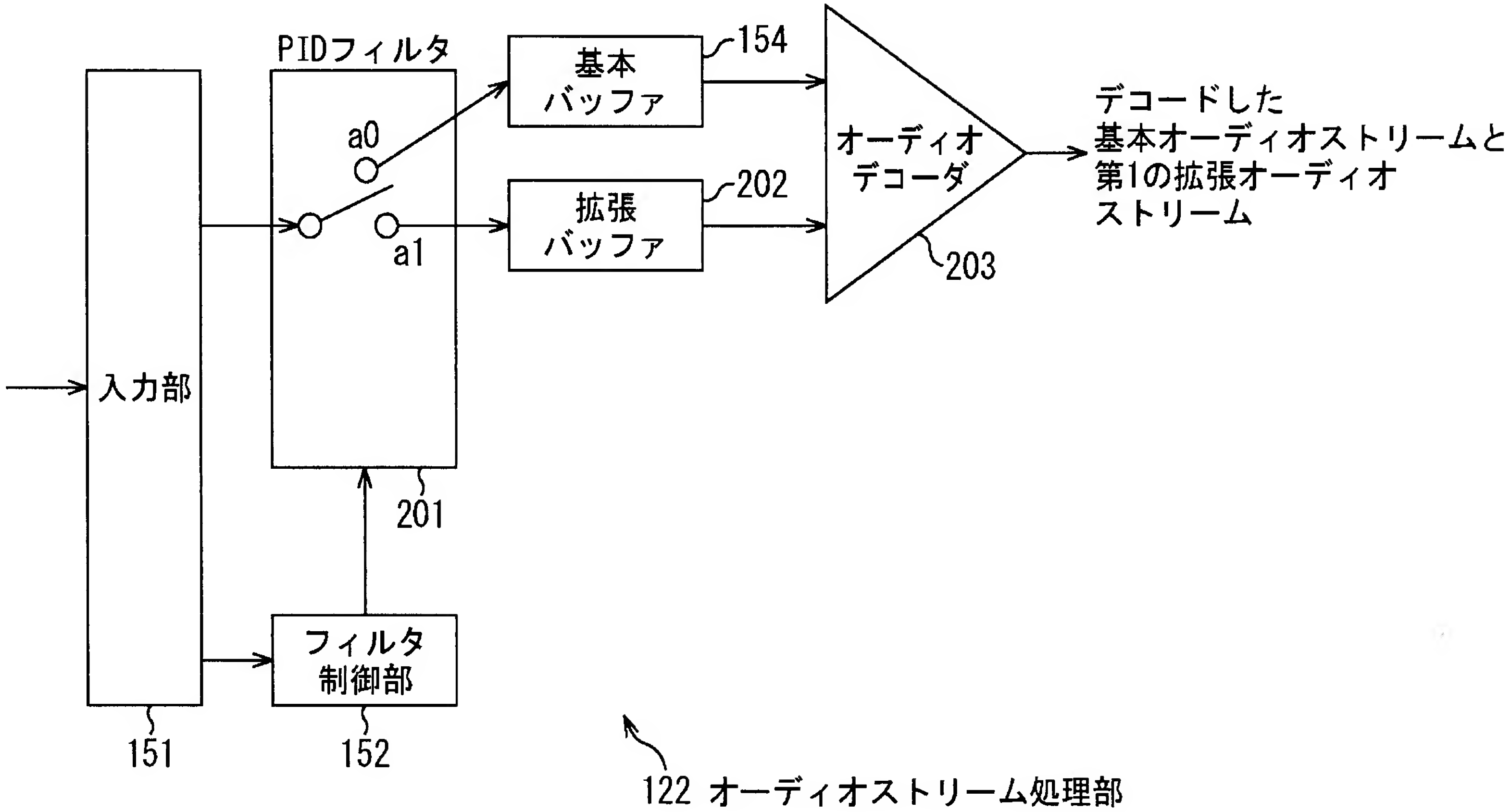


図12
TSパケット生成処理スタート
受信部はTSパケットを受信する
S51
受信部はオーディオストリームのTSパケットを抽出し、オーディオストリーム処理部に供給する
S52
オーディオストリーム処理
S53
出力部はオーディオストリームを出力する
S54
エンド

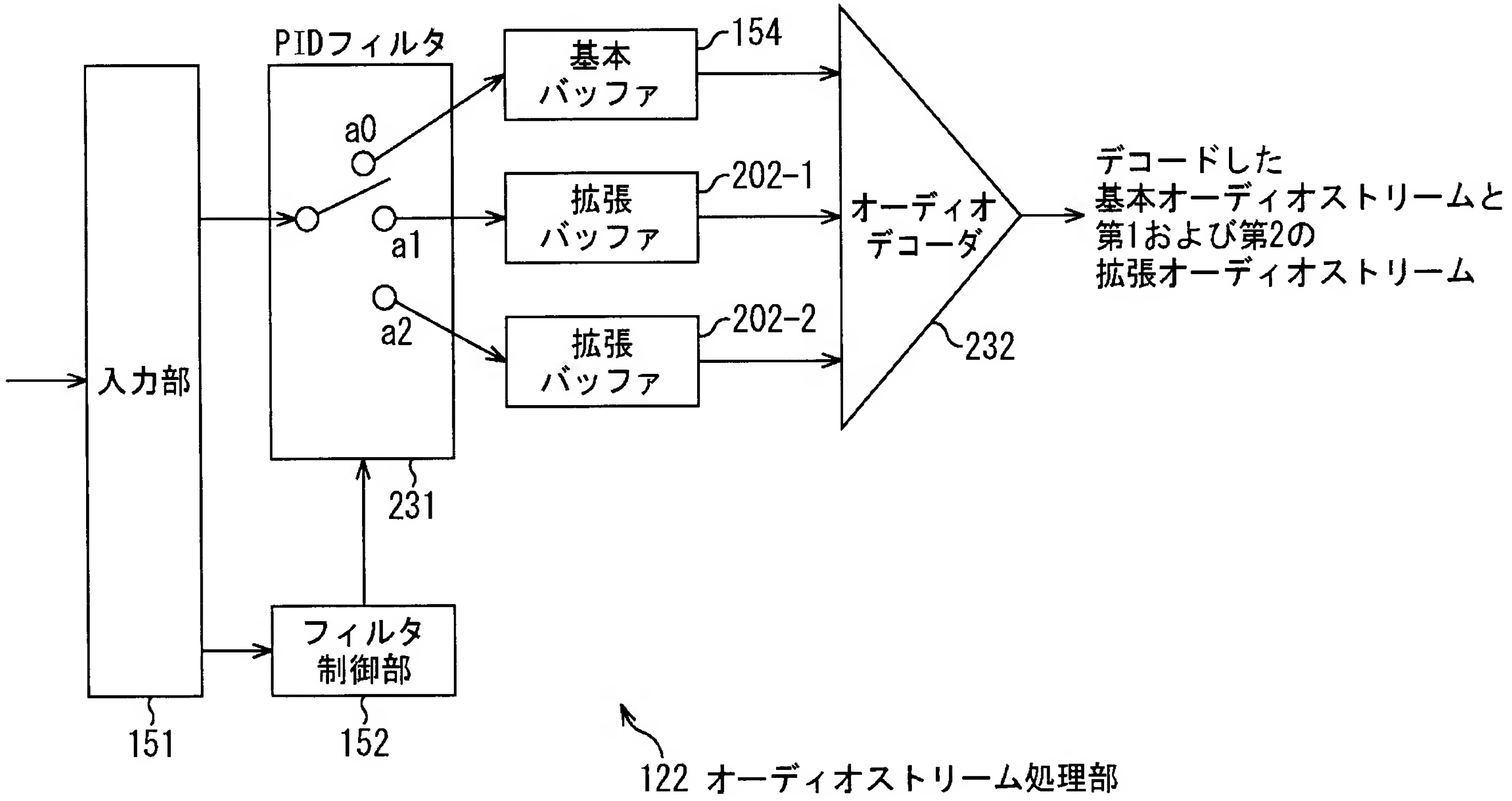
【図１３】
図13


基本オーディオストリーム処理
スタート
入力部はオーディオストリームの
TSパケットの入力を受け付ける
S71
入力部はテーブルのTSパケットを
フィルタ制御部に供給する
S72
入力部はPIDが付されている
TSパケットをPIDフィルタに供給する
S73
フィルタ制御部はテーブルを参照して、
オーディオデコーダが処理できる
ストリームの種類を判断する
S74
PIDフィルタは対応するTSパケットを
選択し、基本バッファに供給する
S75
基本バッファはTSパケットを格納する
S76
基本バッファは所定のタイミングで
TSパケットをオーディオデコーダに
出力する
S77
オーディオデコーダはTSパケットを
デコードする
S78
オーディオデコーダはデコードした
オーディオストリームを出力する
S79
リターン

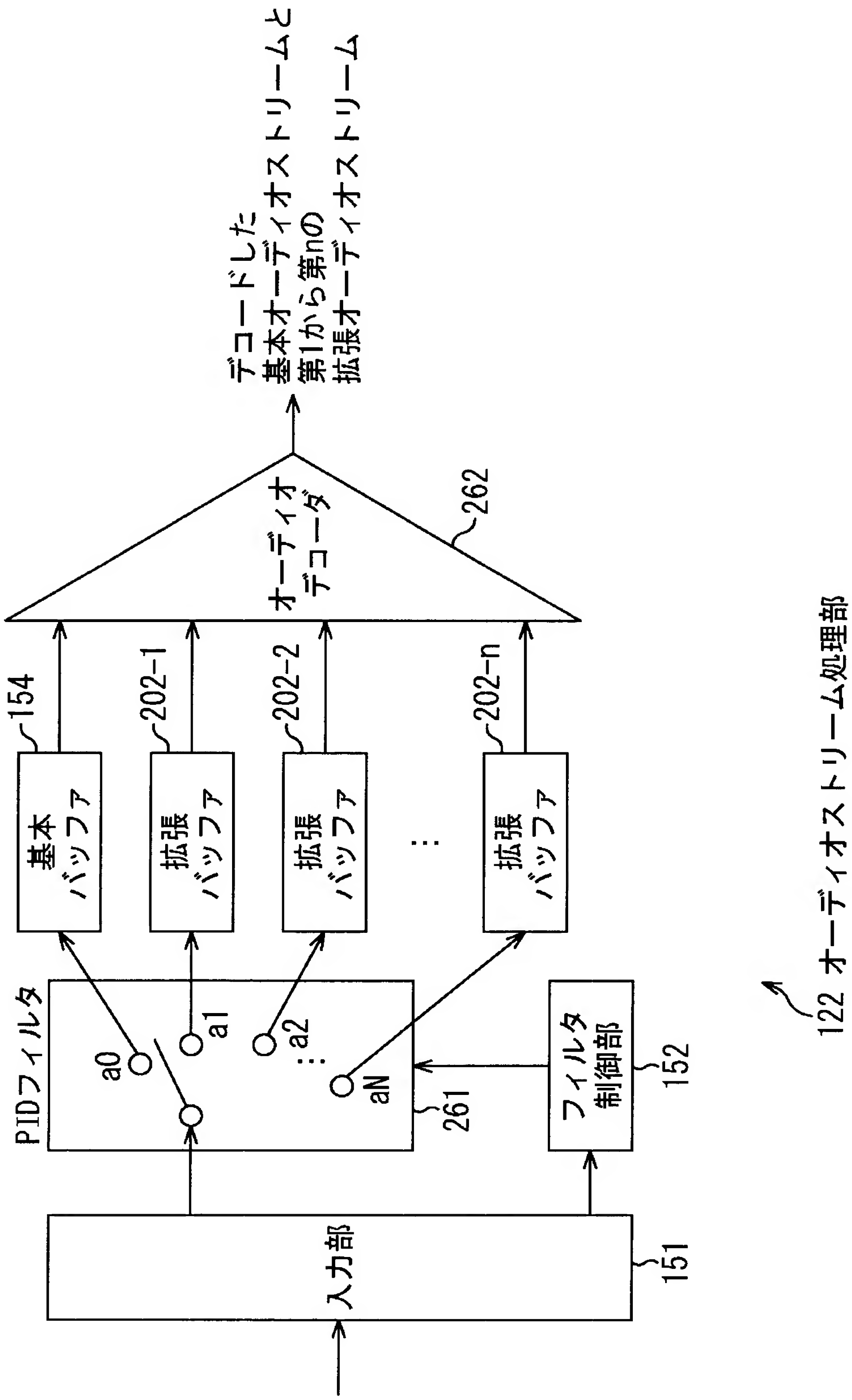
【図１４】
図14


入力部
151
PIDフィルタ
a0
a1
201
フィルタ制御部
152
基本バッファ
154
拡張バッファ
202
オーディオデコーダ
203
デコードした
基本オーディオストリームと
第1の拡張オーディオ
ストリーム
122 オーディオストリーム処理部

【図１５】
図15


入力部
151
PIDフィルタ
a0
a1
a2
231
フィルタ
制御部
152
基本
バッファ
154
拡張
バッファ
202-1
拡張
バッファ
202-2
オーディオ
デコーダ
232
デコードした
基本オーディオストリームと
第1および第2の
拡張オーディオストリーム
122 オーディオストリーム処理部

【図１６】
図16



入力部
151
PIDフィルタ
261
a0
a1
a2
aN
フィルタ制御部
152
基本バッファ
154
拡張バッファ
202-1
拡張バッファ
202-2
拡張バッファ
202-n
オーディオデコーダ
262
デコードした基本オーディオストリームと第1から第nの拡張オーディオストリーム
122 オーディオストリーム処理部

【図１７】

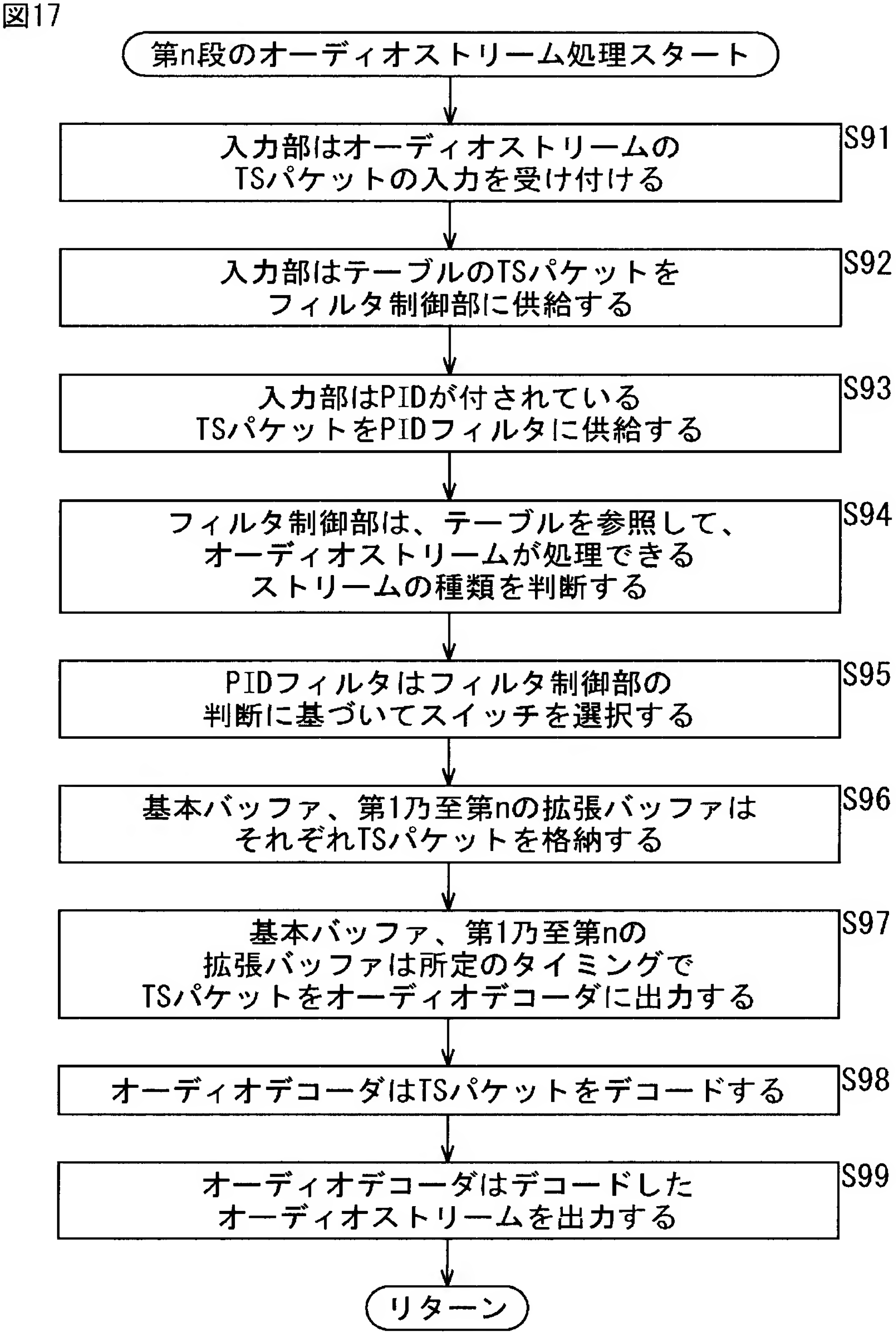
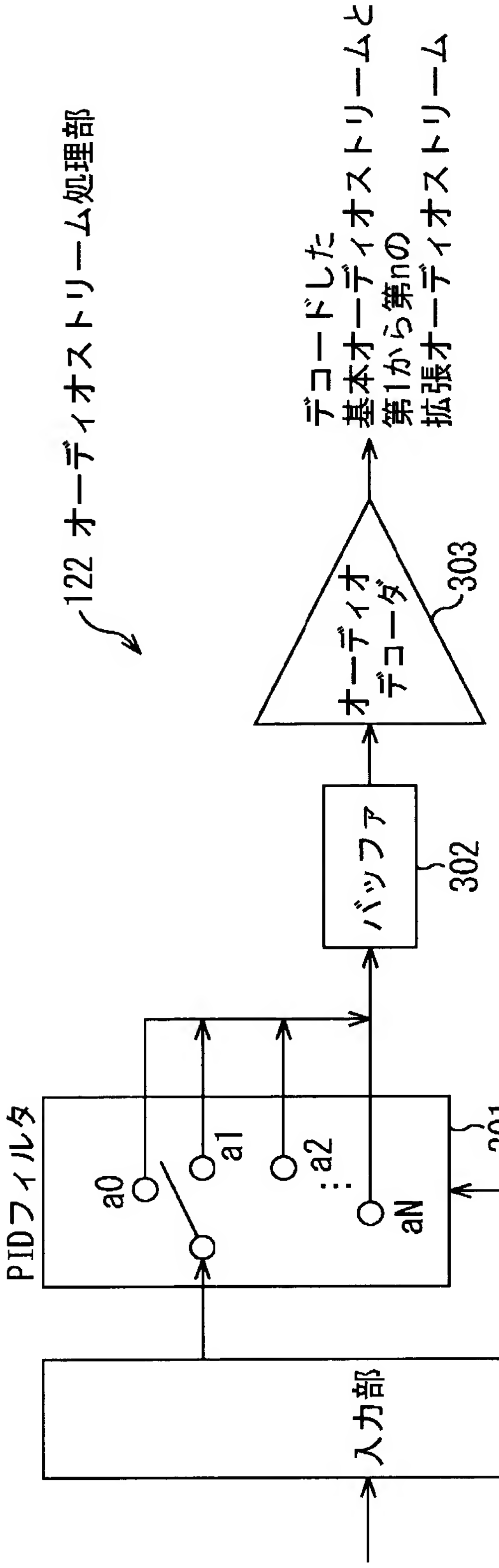
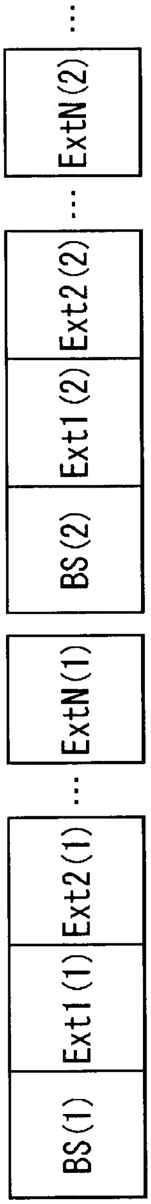


図17
第n段のオーディオストリーム処理スタート
入力部はオーディオストリームのTSパケットの入力を受け付ける
S91
入力部はテーブルのTSパケットをフィルタ制御部に供給する
S92
入力部はPIDが付されているTSパケットをPIDフィルタに供給する
S93
フィルタ制御部は、テーブルを参照して、オーディオストリームが処理できるストリームの種類を判断する
S94
PIDフィルタはフィルタ制御部の判断に基づいてスイッチを選択する
S95
基本バッファ、第1乃至第nの拡張バッファはそれぞれTSパケットを格納する
S96
基本バッファ、第1乃至第nの拡張バッファは所定のタイミングでTSパケットをオーディオデコーダに出力する
S97
オーディオデコーダはTSパケットをデコードする
S98
オーディオデコーダはデコードしたオーディオストリームを出力する
S99
リターン

【図１８】
図18

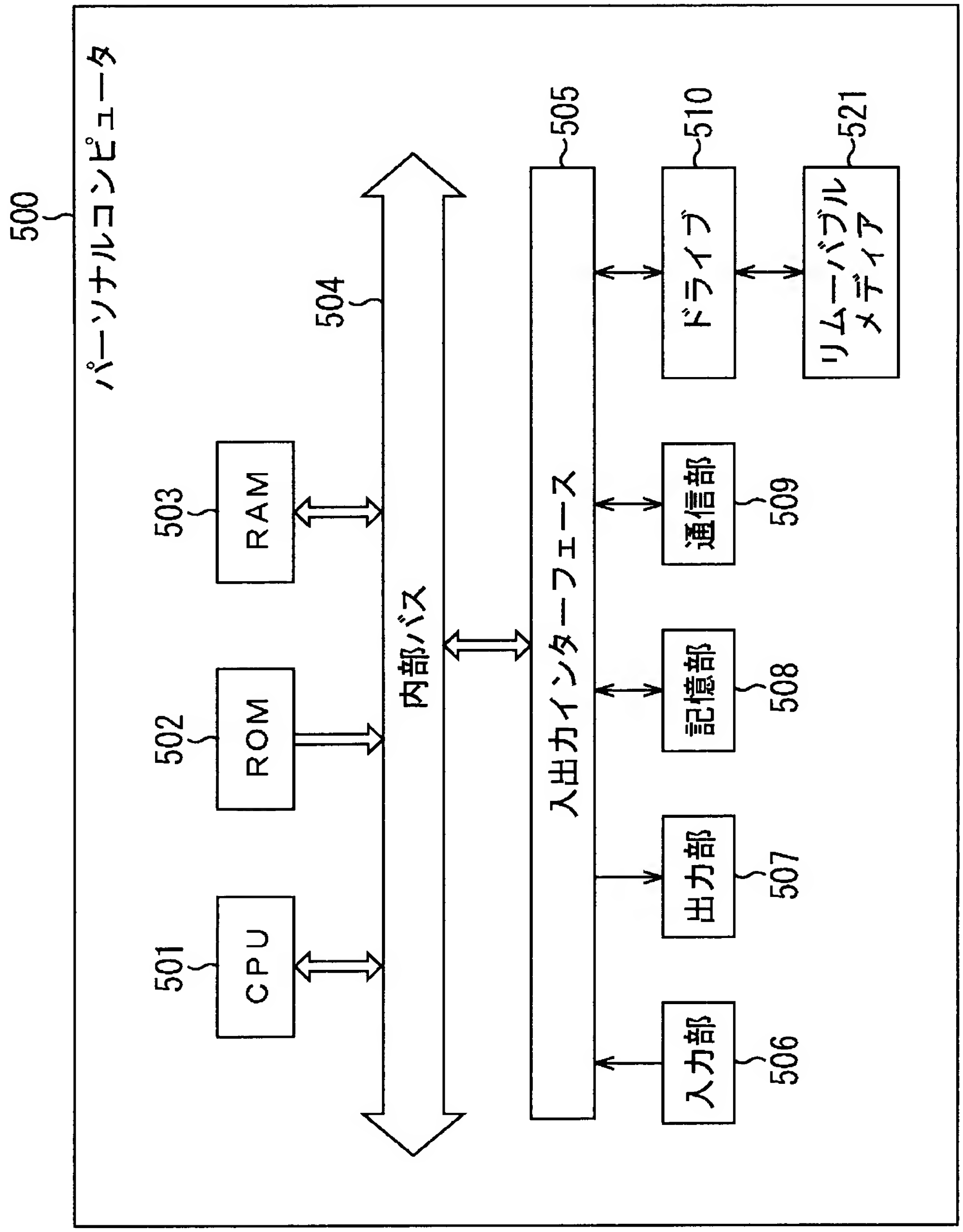

122 オーディオストリーム処理部
入力部
151
PIDフィルタ
a0
a1
a2
aN
301
フィルタ制御部
152
バッファ
302
オーディオデコーダ
303
デコードした
基本オーディオストリームと
第1から第nの
拡張オーディオストリーム

【図１９】
図19



BS(1)
Ext1(1)
Ext2(1)
…
ExtN(1)
BS(2)
Ext1(2)
Ext2(2)
…
ExtN(2)
…

【図２０】
図20


500
パーソナルコンピュータ
501
CPU
502
ROM
503
RAM
504
内部バス
505
入出力インターフェース
506
入力部
507
出力部
508
記憶部
509
通信部
510
ドライブ
521
リムーバブルメディア

[Fig. 1]

1: PROGRAM STREAM

11: VIDEO PACK

12: MPEG2 AUDIO PACK

13-1 … 13-J: PACK

21: PACK HEADER

22: PES PACKET HEADER

23: MPEG-1 AUDIO DATA (Base)

24: PES PACKET HEADER

25: MPEG-2 AUDIO DATA (Extension)

[Fig. 2]

40: TRANSMITTING/RECEIVING SYSTEM

41: TRANSMITTER

42: RECEIVER

[Fig. 3]

300: AUDIO STREAM

41: TRANSMITTER

71: INPUT SECTION

72: AUDIO ENCODER

73: BASE BUFFER

74-1, 74-2 … 74-N: EXTENSION BUFFER

75: EXTRACTION-INFORMATION ADDING SECTION

76: TS PACKETIZING SECTION

77: TRANSMITTING SECTION

[Fig. 4]

81: BASE AUDIO STREAM (BS)

82-1: FIRST EXTENSION AUDIO STREAM (Ext1)

82-2: SECOND EXTENSION AUDIO STREAM (Ext2)

82-n: N-TH EXTENSION AUDIO STREAM (ExtN)

[Fig. 5]

500: TRANSPORT STREAM (TS)

501: TS PACKET

90: TABLE (PAT)

91: TABLE (PMT)

[Fig. 6]

600: START OF TS PACKET TRANSMITTING PROCESS

S11: INPUT SECTION RECEIVES INPUT OF AUDIO STREAM

S12: INPUT SECTION OUTPUTS AUDIO STREAM TO AUDIO ENCODER

S13: AUDIO ENCODER ENCODES AUDIO STREAM SEPARATELY FOR EACH LEVEL

S14: AUDIO ENCODER OUTPUTS ENCODED AUDIO STREAMS SEPARATELY FOR EACH LEVEL

S15: BASE BUFFER AND FIRST TO N-TH EXTENSION BUFFERS STORE ENCODED AUDIO STREAMS

S16: BASE BUFFER AND FIRST TO N-TH EXTENSION BUFFERS RESPECTIVELY OUTPUT ENCODED AUDIO STREAMS WITH PREDETERMINED TIMING

S17: EXTRACTION-INFORMATION ADDING SECTION GENERATES TABLES AND SUPPLIES TABLES TO TS PACKETIZING SECTION

S18: TS PACKET GENERATING PROCESS

S19: TRANSMITTING SECTION TRANSMITS TS PACKETS

601: END

[Fig. 9]

900: START OF TS PACKET GENERATING PROCESS

S31: ACQUIRE TABLES

S32: PACKETIZE TABLES INTO TS PACKETS AND OUTPUT TS PACKETS TO TRANSMITTING SECTION

S33: ADDS PIDS TO AUDIO STREAMS FROM BASE BUFFER AND FIRST TO N-TH EXTENSION BUFFERS BASED ON TABLES

S34: GENERATE TS PACKETS BASED ON AUDIO STREAMS FROM BASE BUFFER AND FIRST TO N-TH EXTENSION BUFFERS

S35: OUTPUT GENERATED TS PACKETS TO TRANSMITTING SECTION

901: RETURN

[Fig. 10]

42: RECEIVER

121: RECEIVING SECTION

122: AUDIO-STREAM PROCESSING SECTION

123: OUTPUT SECTION

[Fig. 11]

122: AUDIO-STREAM PROCESSING SECTION

151: INPUT PORTION

152: FILTER CONTROL PORTION

153: PID FILTER

154: BASE BUFFER

155: AUDIO DECODER

1100: DECODED BASE AUDIO STREAM

[Fig. 12]

1200: START OF TS PACKET GENERATING PROCESS

S51: RECEIVING SECTION RECEIVES TS PACKETS

S52: RECEIVING SECTION EXTRACTS TS PACKETS OF AUDIO STREAM AND SUPPLIES TS PACKETS TO AUDIO-STREAM PROCESSING SECTION

S53: AUDIO STREAM PROCESSING PROCESS

S54: OUTPUT SECTION OUTPUTS AUDIO STREAM

1201: END

[Fig. 13]

1300: START OF BASE AUDIO STREAM PROCESSING PROCESS

S71: INPUT PORTION RECEIVES INPUT OF TS PACKETS OF AUDIO STREAM

S72: INPUT PORTION SUPPLIES TS PACKETS OF TABLES TO FILTER CONTROL PORTION

S73: INPUT PORTION SUPPLIES TS PACKETS TO WHICH PIDS ARE ADDED TO PID FILTER

S74: FILTER CONTROL PORTION REFERS TO TABLES AND DETERMINES TYPE OF STREAM THAT AUDIO DECODER CAN PROCESS

S75: PID FILTER SELECTS CORRESPONDING TS PACKETS AND SUPPLIES TS PACKETS TO BASE BUFFER

S76: BASE BUFFER STORES TS PACKETS

S77: BASE BUFFER OUTPUTS TS PACKETS TO AUDIO DECODER WITH PREDETERMINED TIMING

S78: AUDIO DECODER DECODES TS PACKETS

S79: AUDIO DECODER OUTPUTS DECODED AUDIO STREAM

1301: RETURN

[Fig. 14]

122: AUDIO-STREAM PROCESSING SECTION

151: INPUT PORTION

152: FILTER CONTROL PORTION

201: PID FILTER

154: BASE BUFFER

202: EXTENSION BUFFER

203: AUDIO DECODER

1400: DECODED BASE AUDIO STREAM AND FIRST EXTENSION AUDIO STREAM

[Fig. 15]

122: AUDIO-STREAM PROCESSING SECTION

151: INPUT PORTION

152: FILTER CONTROL PORTION

231: PID FILTER

154: BASE BUFFER

202-1, 202-2: EXTENSION BUFFER

232: AUDIO DECODER

1500: DECODED BASE AUDIO STREAM AND FIRST AND SECOND EXTENSION AUDIO STREAMS

[Fig. 16]

122: AUDIO-STREAM PROCESSING SECTION

151: INPUT PORTION

152: FILTER CONTROL PORTION

261: PID FILTER

154: BASE BUFFER

202-1, 202-2 … 202-N: EXTENSION BUFFER

262: AUDIO DECODER

1600: DECODED BASE AUDIO STREAM AND FIRST TO N-TH EXTENSION AUDIO STREAMS

[Fig. 17]

1700: START OF N-TH AUDIO STREAM PROCESSING PROCESS

S91: INPUT PORTION RECEIVES INPUT OF TS PACKETS OF AUDIO STREAM

S92: INPUT PORTION SUPPLIES TS PACKETS OF TABLES TO FILTER CONTROL PORTION

S93: INPUT PORTION SUPPLIES TS PACKETS TO WHICH PIDS ARE ADDED TO PID FILTER

S94: FILTER CONTROL PORTION REFERS TO TABLES AND DETERMINES TYPES OF STREAMS THAT AUDIO STREAM CAN PROCESS

S95: PID FILTER SELECTS SWITCH BASED ON DETERMINATION BY FILTER CONTROL PORTION

S96: BASE BUFFER AND FIRST TO N-TH EXTENSION BUFFERS STORE CORRESPONDING TS PACKETS

S97: BASE BUFFER AND FIRST TO N-TH EXTENSION BUFFERS OUTPUT TS PACKETS TO AUDIO DECODER WITH PREDETERMINED TIMING

S98: AUDIO DECODER DECODES TS PACKETS

S99: AUDIO DECODER OUTPUTS DECODED AUDIO STREAM

1701: RETURN

[Fig. 18]

122: AUDIO-STREAM PROCESSING SECTION

151: INPUT PORTION

152: FILTER CONTROL PORTION

301: PID FILTER

302: BUFFER

303: AUDIO DECODER

1800: DECODED BASE AUDIO STREAM AND FIRST TO N-TH EXTENSION AUDIO STREAMS

[Fig. 20]

500: PERSONAL COMPUTER

504: INTERNAL BUS

505: INPUT/OUTPUT INTERFACE

506: INPUT SECTION

507: OUTPUT SECTION

508: STORAGE SECTION

509: COMMUNICATION SECTION

510: DRIVE

521: REMOVABLE MEDIUM

[Name of Document] ABSTRACT

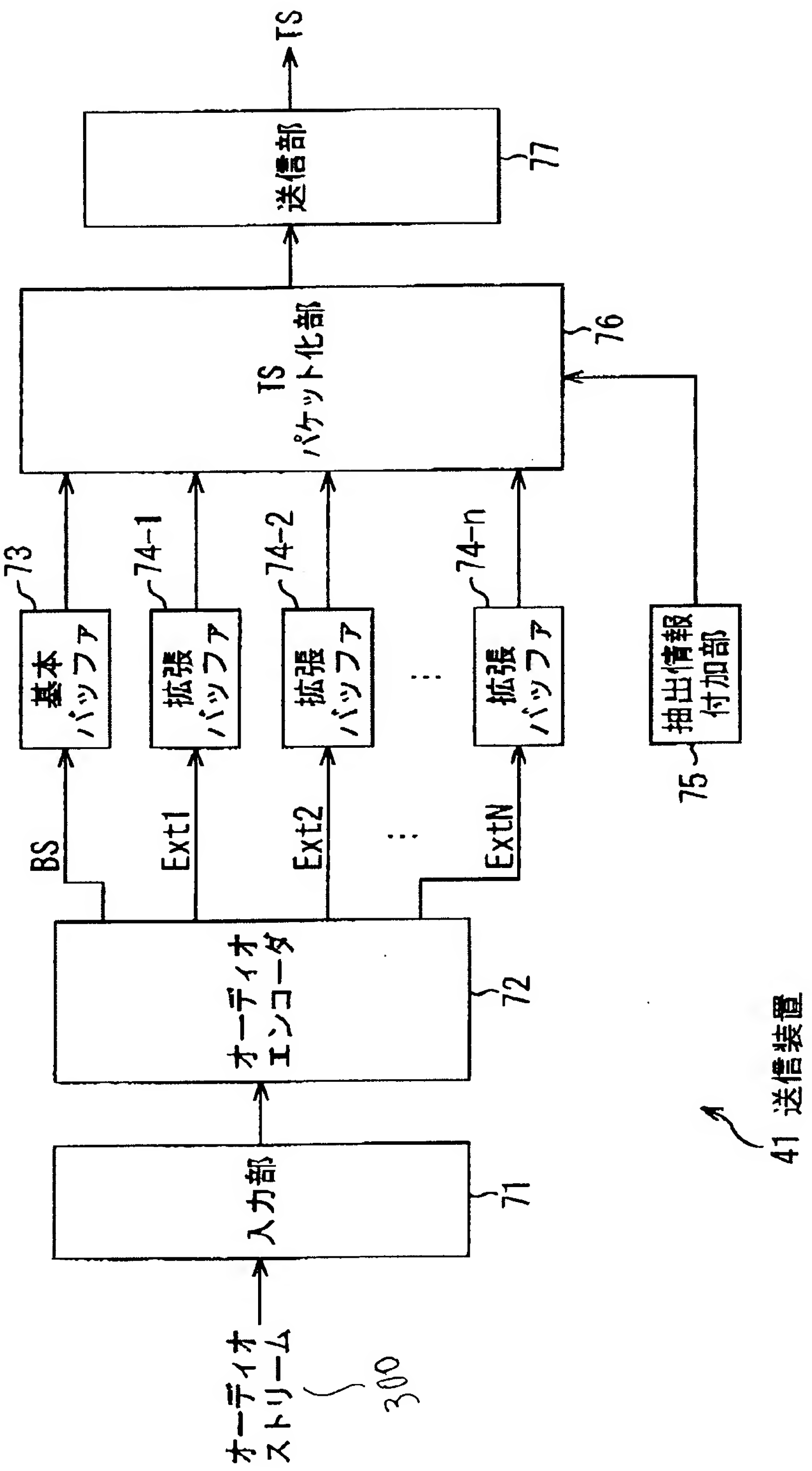
[Abstract]

[Object] To process a stream including a base stream and extension streams at a plurality of levels.

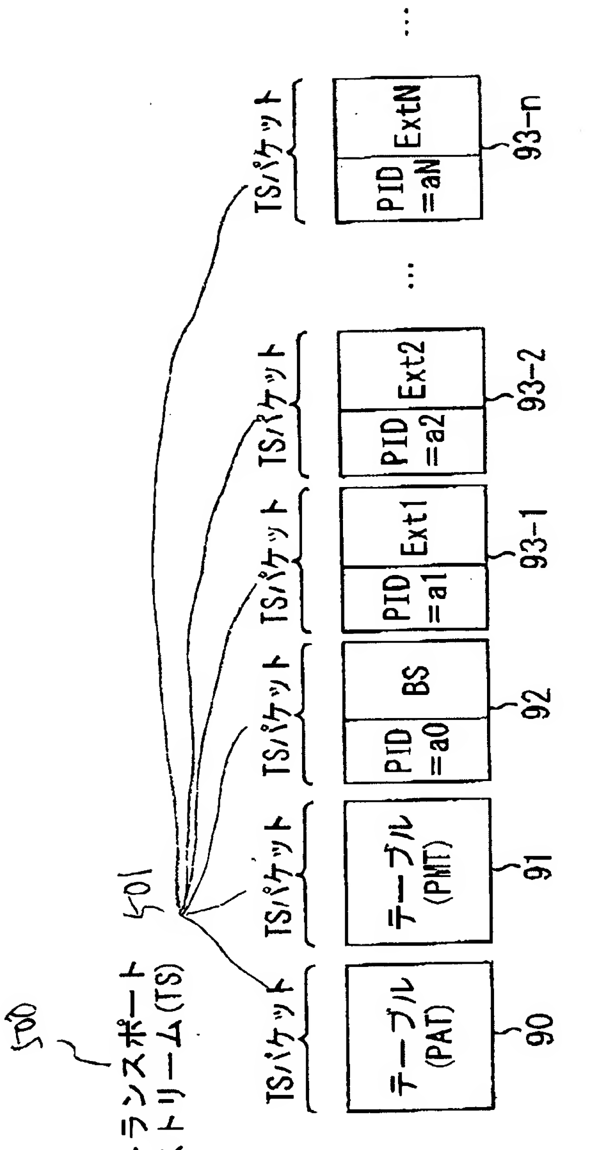
[Solving Means] A transmitter encodes an audio stream into a base stream BS and first to n-th extension streams Ext1 to ExtN. The transmitter refers to tables 90 and 91, generates TS packets 92 and 93-1 to 93-n having PIDs for the corresponding types of streams and TS packets 90 and 91 of the tables, and transmits the generated TS packets to a receiver. The receiver refers to the TS packets 90 and 91 of the tables and determines the type(s) of stream(s) that it can process. The receiver selects the TS packets having the PID(s) associated with the stream(s) that it can process and decodes the TS packets. The present invention is applicable to a transmitter and a receiver that perform encoding and decoding.

[Selected Figure] Fig. 5

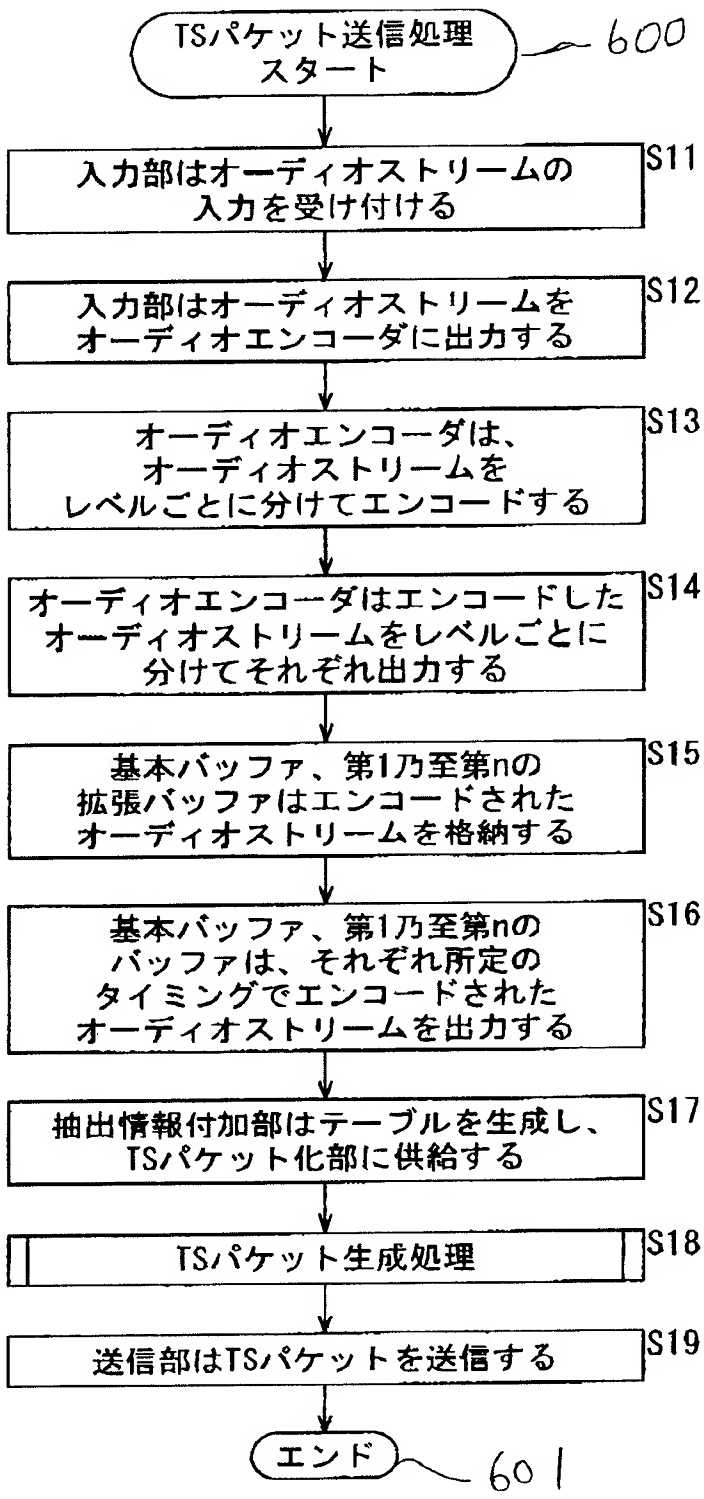
【図３】
図3


オーディオストリーム
300
入力部
71
オーディオエンコーダ
72
BS
Ext1
Ext2
ExtN
基本バッファ
73
拡張バッファ
74-1
拡張バッファ
74-2
拡張バッファ
74-n
抽出情報付加部
75
TSパケット化部
76
送信部
77
TS
41 送信装置

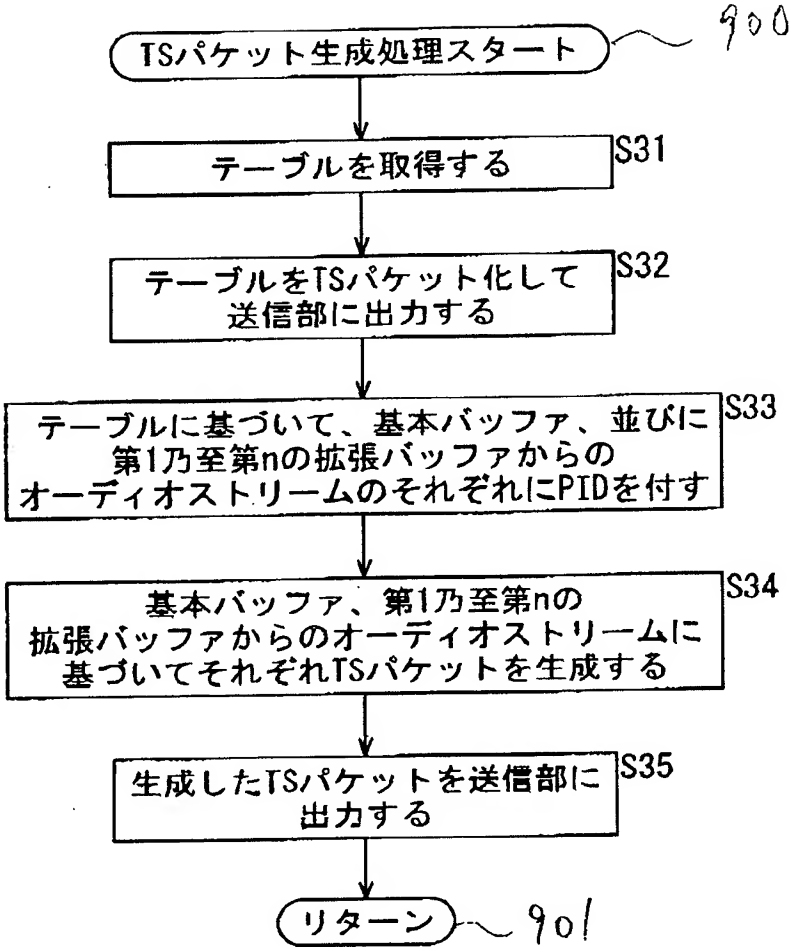
【図５】
図5


500
トランスポートストリーム(TS)
501
TSパケット
テーブル(PAT)
90
TSパケット
テーブル(PMT)
91
TSパケット
PID =a0
BS
92
TSパケット
PID =a1
Ext1
93-1
TSパケット
PID =a2
Ext2
93-2
…
TSパケット
PID =aN
ExtN
93-n
…

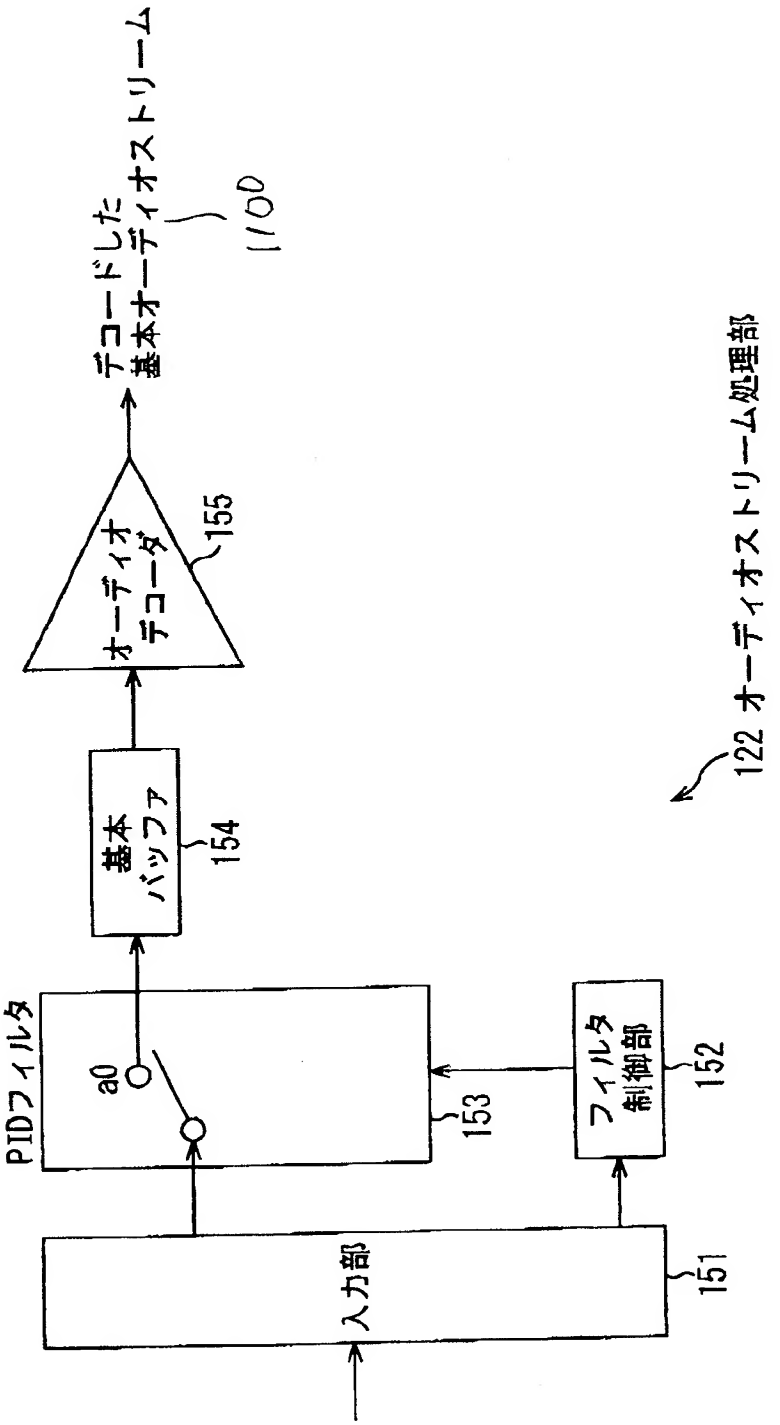
【図６】
図6


TSパケット送信処理
スタート
600
入力部はオーディオストリームの
入力を受け付ける
S11
入力部はオーディオストリームを
オーディオエンコーダに出力する
S12
オーディオエンコーダは、
オーディオストリームを
レベルごとに分けてエンコードする
S13
オーディオエンコーダはエンコードした
オーディオストリームをレベルごとに
分けてそれぞれ出力する
S14
基本バッファ、第1乃至第nの
拡張バッファはエンコードされた
オーディオストリームを格納する
S15
基本バッファ、第1乃至第nの
バッファは、それぞれ所定の
タイミングでエンコードされた
オーディオストリームを出力する
S16
抽出情報付加部はテーブルを生成し、
TSパケット化部に供給する
S17
TSパケット生成処理
S18
送信部はTSパケットを送信する
S19
エンド
601

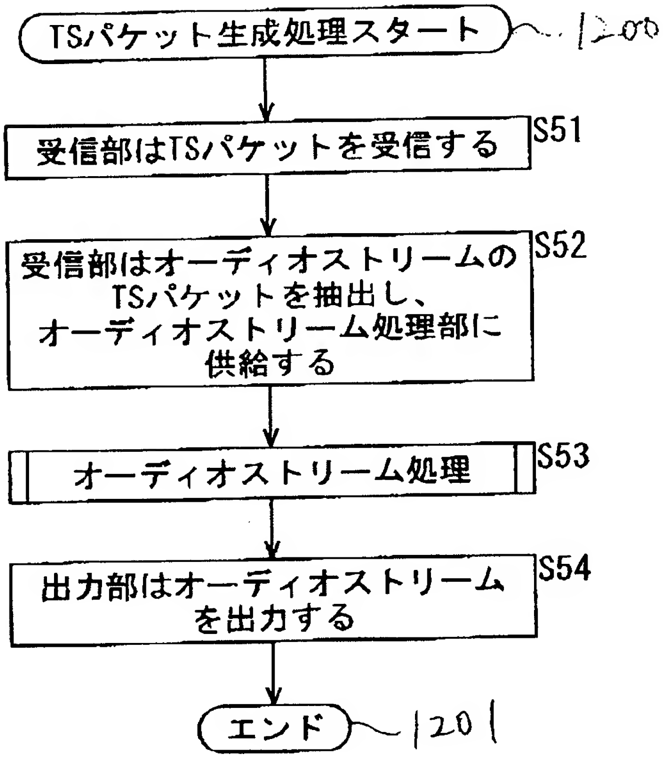
【図９】
図9


TSパケット生成処理スタート
900
テーブルを取得する
S31
テーブルをTSパケット化して送信部に出力する
S32
テーブルに基づいて、基本バッファ、並びに第1乃至第nの拡張バッファからのオーディオストリームのそれぞれにPIDを付す
S33
基本バッファ、第1乃至第nの拡張バッファからのオーディオストリームに基づいてそれぞれTSパケットを生成する
S34
生成したTSパケットを送信部に出力する
S35
リターン
901

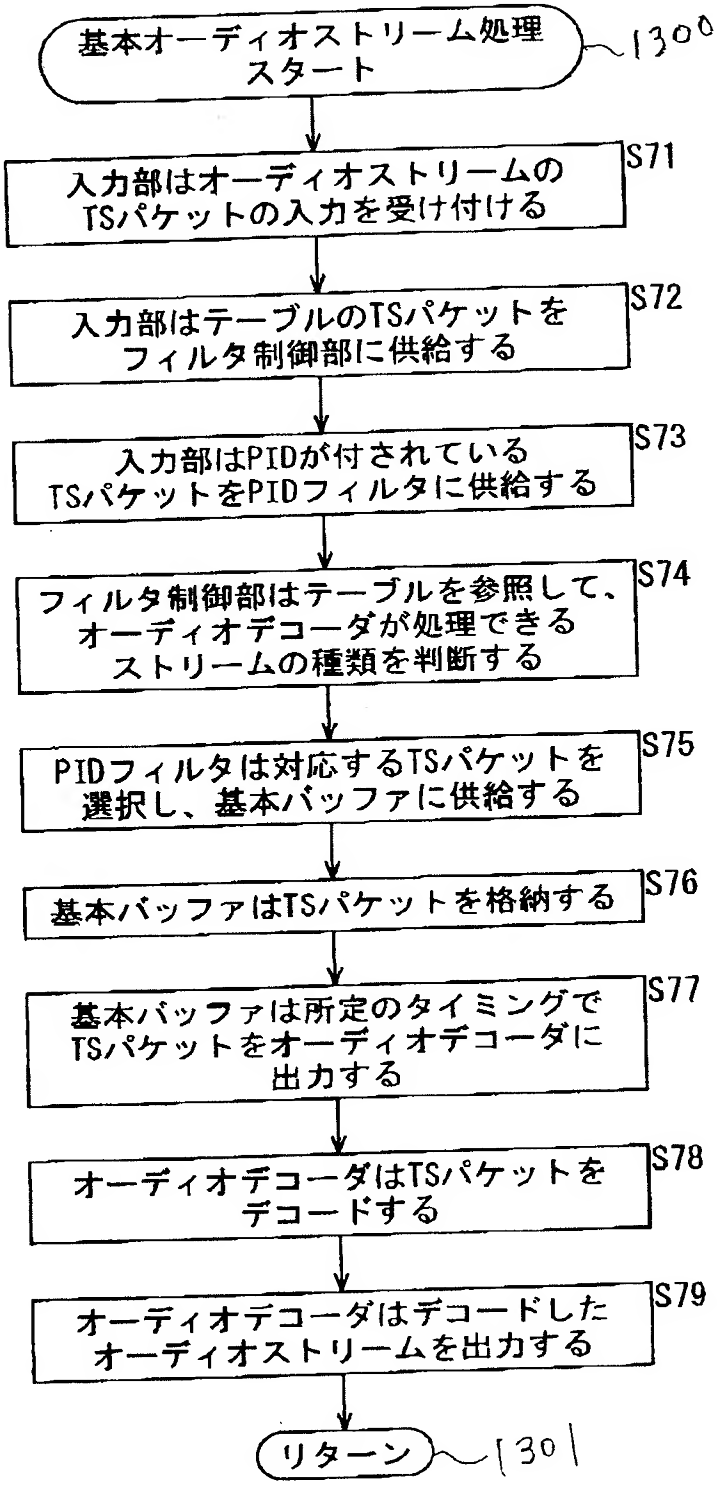
【図１１】
図11


入力部
151
PIDフィルタ
a0
153
フィルタ制御部
152
基本バッファ
154
オーディオデコーダ
155
デコードした基本オーディオストリーム
1100
122 オーディオストリーム処理部

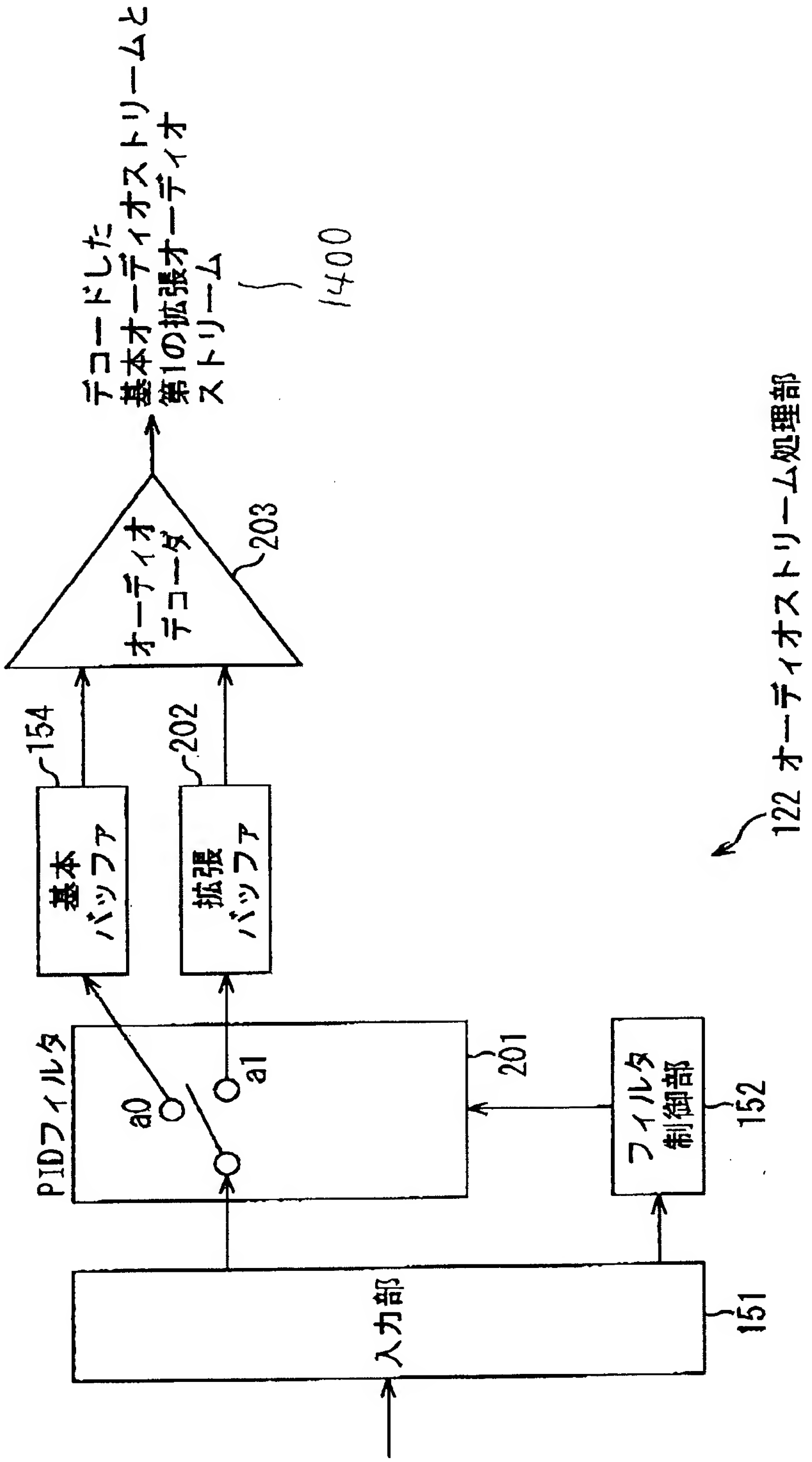
【図１２】
図12


TSパケット生成処理スタート
1200
受信部はTSパケットを受信する
S51
受信部はオーディオストリームのTSパケットを抽出し、オーディオストリーム処理部に供給する
S52
オーディオストリーム処理
S53
出力部はオーディオストリームを出力する
S54
エンド
1201

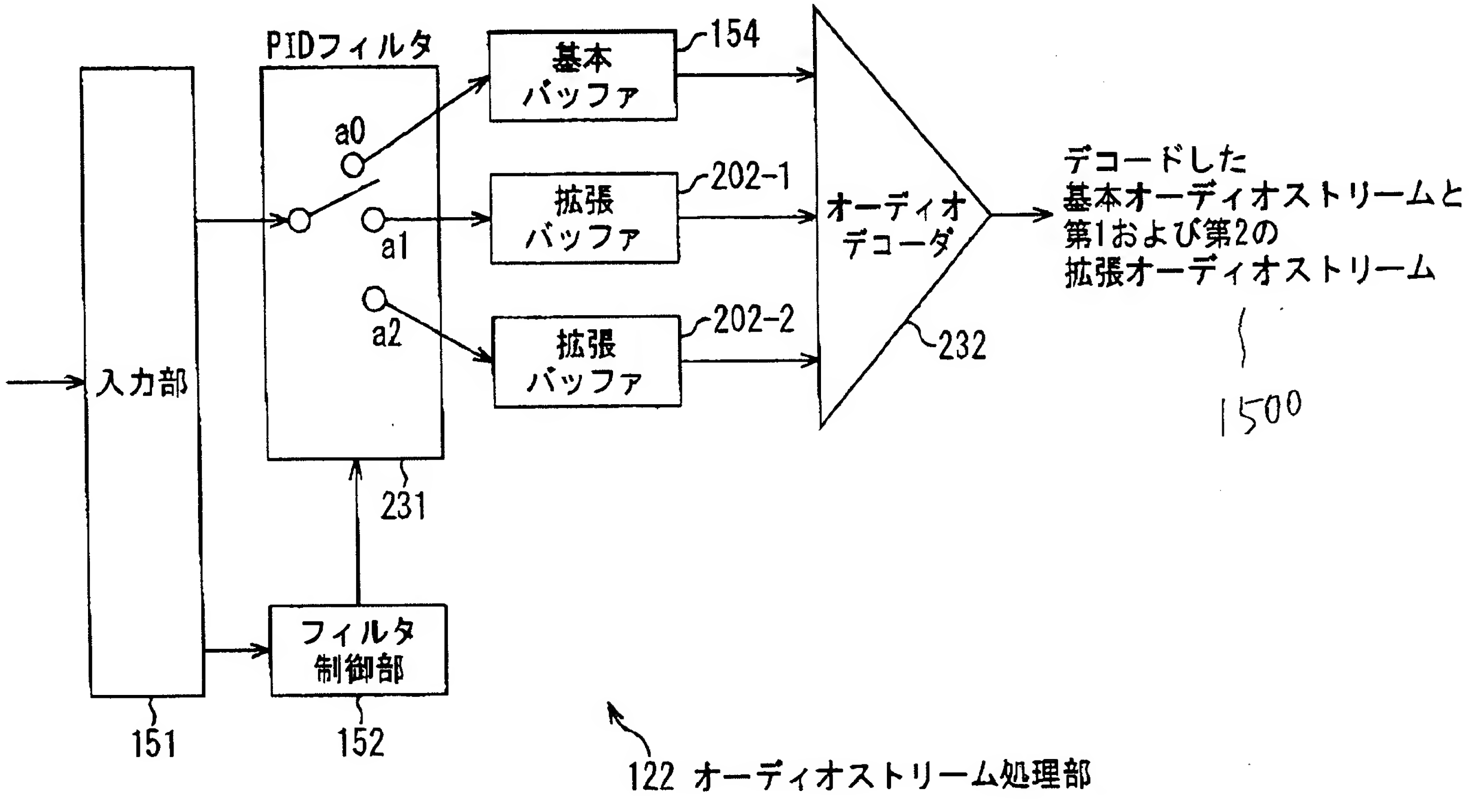
【図１３】
図13


基本オーディオストリーム処理
スタート
1300
S71
入力部はオーディオストリームの
TSパケットの入力を受け付ける
S72
入力部はテーブルのTSパケットを
フィルタ制御部に供給する
S73
入力部はPIDが付されている
TSパケットをPIDフィルタに供給する
S74
フィルタ制御部はテーブルを参照して、
オーディオデコーダが処理できる
ストリームの種類を判断する
S75
PIDフィルタは対応するTSパケットを
選択し、基本バッファに供給する
S76
基本バッファはTSパケットを格納する
S77
基本バッファは所定のタイミングで
TSパケットをオーディオデコーダに
出力する
S78
オーディオデコーダはTSパケットを
デコードする
S79
オーディオデコーダはデコードした
オーディオストリームを出力する
リターン
1301

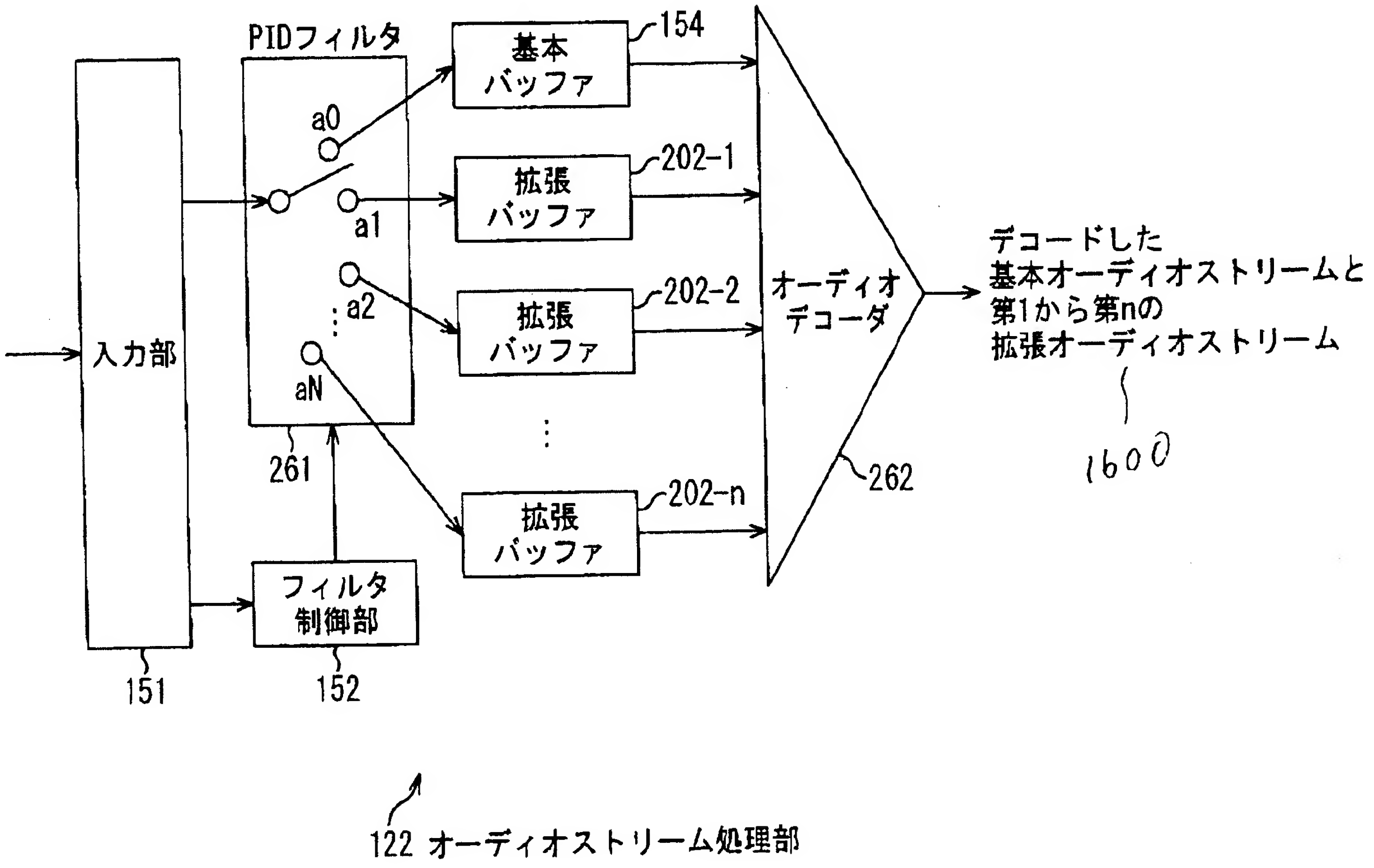
【図１４】
図14


入力部
151
PIDフィルタ
a0
a1
201
フィルタ
制御部
152
基本
バッファ
154
拡張
バッファ
202
オーディオ
デコーダ
203
デコードした
基本オーディオストリームと
第1の拡張オーディオ
ストリーム
1400
122 オーディオストリーム処理部

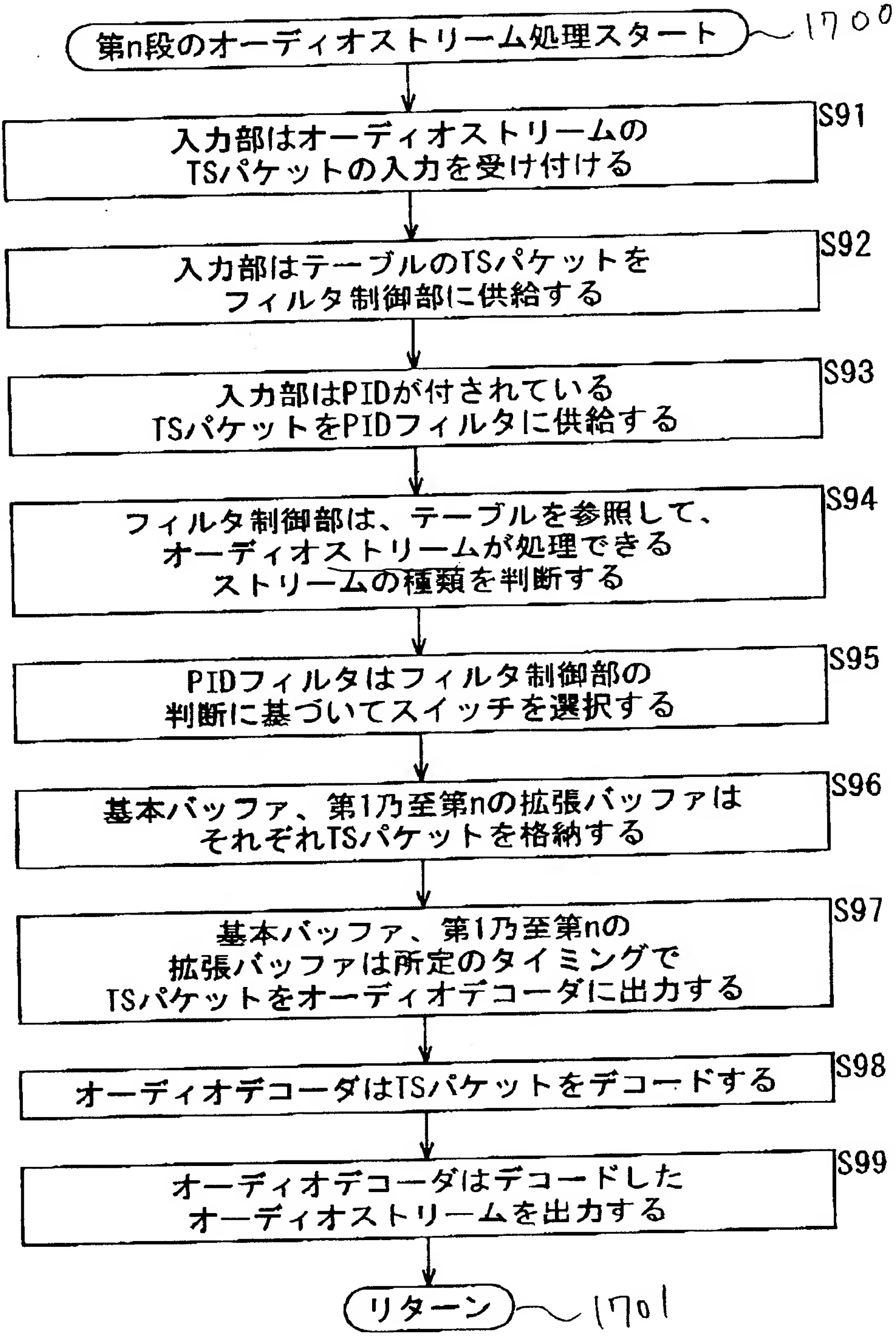
【図１５】
図15


入力部
151
PIDフィルタ
a0
a1
a2
231
フィルタ
制御部
152
基本
バッファ
154
拡張
バッファ
202-1
拡張
バッファ
202-2
オーディオ
デコーダ
232
デコードした
基本オーディオストリームと
第1および第2の
拡張オーディオストリーム
1500
122 オーディオストリーム処理部

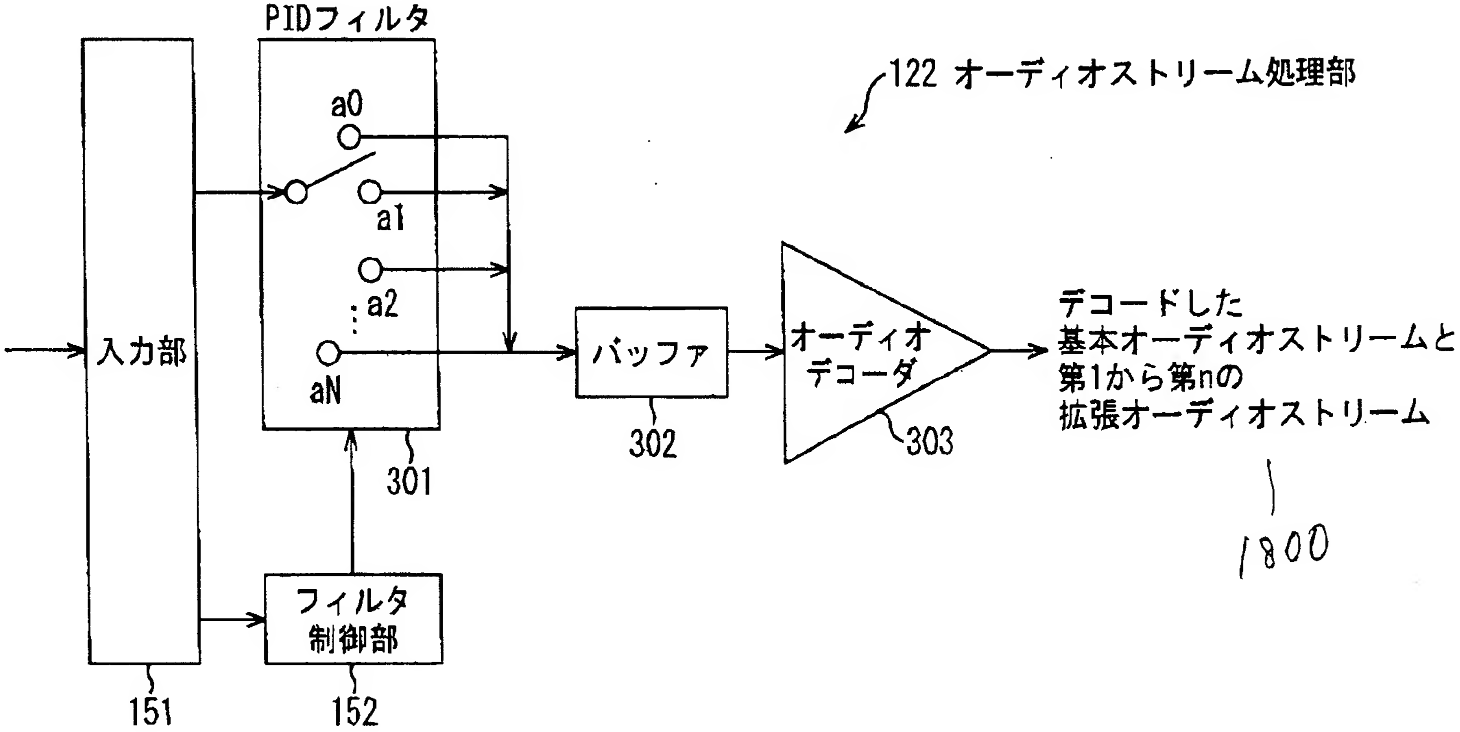
【図１６】
図16


入力部
151
PIDフィルタ
a0
a1
a2
aN
261
フィルタ
制御部
152
基本
バッファ
154
拡張
バッファ
202-1
拡張
バッファ
202-2
拡張
バッファ
202-n
オーディオ
デコーダ
262
デコードした
基本オーディオストリームと
第1から第nの
拡張オーディオストリーム
1600
122 オーディオストリーム処理部

【図１７】
図17


第n段のオーディオストリーム処理スタート
1700
入力部はオーディオストリームのTSパケットの入力を受け付ける
S91
入力部はテーブルのTSパケットをフィルタ制御部に供給する
S92
入力部はPIDが付されているTSパケットをPIDフィルタに供給する
S93
フィルタ制御部は、テーブルを参照して、オーディオストリームが処理できるストリームの種類を判断する
S94
PIDフィルタはフィルタ制御部の判断に基づいてスイッチを選択する
S95
基本バッファ、第1乃至第nの拡張バッファはそれぞれTSパケットを格納する
S96
基本バッファ、第1乃至第nの拡張バッファは所定のタイミングでTSパケットをオーディオデコーダに出力する
S97
オーディオデコーダはTSパケットをデコードする
S98
オーディオデコーダはデコードしたオーディオストリームを出力する
S99
リターン
1701

【図１８】
図18


122 オーディオストリーム処理部
入力部
151
PIDフィルタ
a0
a1
a2
aN
301
フィルタ
制御部
152
バッファ
302
オーディオ
デコーダ
303
デコードした
基本オーディオストリームと
第1から第nの
拡張オーディオストリーム
1800